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ABSTRACT

This manual describes the Mathematics Assessment Questionnaire (MAQ) and its development, provides relevant background from the research literature, describes approaches to the reporting and uses of the MAQ (including its use in instructional planning), and presents sample responses from students and classes. The MAQ provides teachers and students with a tool to understand aspects of constructing knowledge in mathematics classrooms for grades 7 through 9. The questionnaire is intended to survey students' thoughts and feelings about learning a particular aspect of mathematics--solving mathematical word problems. The MAQ provides additional, complementary information to that provided by teacher assessments or standardized tests of mathematical concepts and procedures. The MAQ contains 162 statements and can be completed by most students within 40 minutes. In the first of 2 sections of the questionnaire, students solve a non-routine word problem and respond to 20 statements about what they did while solving the problem. In the second section, students respond to statements grouped within three activity settings (participating in the class as a whole, working with other students, and doing homework), after which the students' cognitive processes within each of these settings are again assessed, and affective beliefs, motivation, and attributions are studied. Three data tables and 10 figures are included. Appendices include sample responses for the fall 1988 sample; preliminary results of teacher ratings of items; statement numbers, scale response numbers for indicators, and interpretation of diagnostic indicators for beliefs, motivations, and attribution categories; the questionnaire; and the hand tally form. (TJH)

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MATHEMATICS ASSESSMENT QUESTIONNAIRE: A SURVEY OF THOUGHTS AND FEELINGS FOR STUDENTS IN GRADES 7 - 9

MANUAL FOR USERS

Carol Kehr Tittle
Deborah Hecht

Research Edition

Center for Advanced Study in Education
The Graduate School and University Center
of the City University of New York

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TABLE OF CONTENTS

PAGE

ACKNOWLEDGEMENTS i

LIST OF TABLES iv

LIST OF FIGURES v

I. INTRODUCTION TO THE MATHEMATICS ASSESSMENT QUESTIONNAIRE

General Uses of the Mathematics Assessment Questionnaire I - 1
General Description 2
Views of the Learner and Teacher 5

II. CLASSROOM ACTIVITIES, THOUGHTS AND FEELINGS, AND THE MATHEMATICS ASSESSMENT QUESTIONNAIRE

Directed Cognition: Self-Direction of Learning II-1
  Metacognition 1
  Self-Regulation 3
Intentionality: Thoughts and Feelings About Learning 4
  Affective Beliefs--Value, Interests, Confidence, Anxiety 5
  Motivations--Learning and Performance Goals 7
  Attributions--Causes of Successful and Unsuccessful Performance, Unknown Control 7

III. DEVELOPMENT AND APPROACHES TO USE

Development Studies III- 1
Approaches to Use 9
  Directed Cognition 9
  Intentionality: Criterion-Referenced Approach 12

IV. CLASSROOM USE: ASSESSMENT AND INSTRUCTIONAL PLANNING

Administration IV- 1
Class Summaries 2
Sample Report Forms 7
Using Student Responses: During Class When Teaching about Solving Mathematical Word Problems 12
  Self-Regulatory Statements 14
  Affective Beliefs 18
  Motivations 25
  Attributions 26

Using Student Responses: Working with Other Students in a Group Solving Mathematical Word Problems IV-27
Self-Regulatory Statements 27
Affective Beliefs 30
Motivations 33
Attributions 33

Using Student Responses: When Working Mathematical Word Problems for Homework 34
Self-Regulatory Statements 36
Affective Beliefs 38
Motivations 44
Attributions 45

REFERENCES

APPENDIXES

3-1 Fall 1988 Sample: Responses for grades 7, 8, and 9 for all MAQ Statements

3-2 Preliminary Results of Teacher Ratings: Number and Percentage of Teachers Rating Metacognitive Statements as Appropriate for the Coin Problem

3-3 Statement Numbers, Scale Response Numbers for Indicators, and Interpretation of Diagnostic Indicators for Beliefs, Motivations and Attribution Categories

4-1 Source Questionnaire: Classification of Statements

4-2 Hand Tally Form

LIST OF TABLES

TABLE		PAGE
3-1	Percentage of Students Who Responded YES, MAYBE or NO to the Metacognitive Statements After Working One of Two Different Word Problems	III-3
3-2	Percentage of Students Indicating Liking, Difficulty and Nervousness After Working One of Two Word Problems	III-5
3-3	Percentage of Students Responding TRUE and/or VERY TRUE to Statements Varied in Level of Specificity for two Constructs: Anxiety and Confidence	III-7

LIST OF FIGURES

FIGURE PAGE

1-1 Specifications for the Mathematics Assessment Questionnaire: Number of Statements for Psychological Constructs and Activity Settings I- 4

4-1 Tally of an Eighth-Grade Class for Selected Metacognitive and Self-Regulatory Statements IV- 3

4-2 Tally of an Eighth-Grade Class for Selected Attribution, Motivation and Affective Categories IV- 5

4-3 Tally of an Eighth-Grade Class for VALUE Items in Each Activity Setting- During Class, Working With Others, and Homework (N=25) IV- 8

4-4 CLASS ROSTER. Sample Eighth-Grade Class Roster for Thoughts and Feelings and Activity Settings: Names of Students Who Responded to at Least Two Statements so as to Indicate a Need for Follow-up IV- 9

4-5 CLASSROOM SUMMARY. Sample Eighth-Grade Classroom Summary (N=25) Percentage of Students in Each Category Whose Responses Indicate a Need for Follow-up Activity IV-13

4-6 Number and Percentage (in Parentheses) of Students in an Eighth-Grade Class (N=25) Responding to Self-Regulatory Statements About Working Mathematical Word Problems DURING TEACHER INSTRUCTION IV-16

4-7 Number and Percentage (in Parentheses) of Students in an Eighth-Grade Class (N=25) Responding to Statements About Their Affective Beliefs, Motivations and Attributions About Working Mathematical Word Problems DURING TEACHER INSTRUCTION IV-19

4-8 Number and Percentage (in Parentheses) of Students in an Eighth-Grade Class (N=25) Responding to Self-Regulatory Statements About Working Mathematical Word Problems for HOMEWORK IV-37

4-9 Number and Percentage (in Parentheses) of Students in an Eighth-Grade Class (N=25) Responding to Statements About Their Affective Beliefs, Motivations and Attributions about Working Mathematical Word Problems for HOMEWORK IV-39

CHAPTER I

INTRODUCTION TO THE MATHEMATICS ASSESSMENT QUESTIONNAIRE

The Mathematics Assessment Questionnaire: A survey of thoughts and feelings for students in grades 7-9, provides teachers and students with a tool to understand aspects of constructing knowledge in mathematics classrooms. The questionnaire is intended to provide information on thoughts and feelings in relation to teaching and learning a particular aspect of mathematics, solving mathematical word problems. The questionnaire provides additional, complementary information to that provided by teacher assessments or standardized tests of mathematical concepts and procedures.

The students' thoughts and feelings that are assessed in the Mathematics Assessment Questionnaire include such reflective activities as awareness of cognitive activities or thoughts:

a) when solving an individual, nonroutine word problem,
b) when working word problems during class,
c) when solving a word problem in a group with other students, and
d) when working word problems for homework.

Thoughts and feelings also include those related to affective and motivational beliefs--worry about learning, the reasons for understanding mathematics word problems and the interest or value of mathematics word problems to students.

The Mathematics Assessment Questionnaire is intended to place one of the educational outcomes of schools--developing knowledge about mathematical concepts and procedures as applied in the process of solving word problems--in the context of the thoughts and feelings that students have about doing mathematical word problems in a variety of classroom activity settings. The questionnaire includes many statements that are related to the "mathematical dispositions" of students as described in the Curriculum and Evaluation Standards for School Mathematics of the National Council of Teachers of Mathematics (1989, p.233).

General Uses of the Mathematics Assessment Questionnaire

The Mathematics Assessment Questionnaire can be used in several ways in order to link assessment with instructional planning and decision making:

. the full questionnaire can be given at one time to the entire class and the results examined for individuals and the class;

. the questionnaire can be given in sections over an extended time period, and summarized for individuals and the class;

. the questionnaire can be given in sections and discussed with students at the time each section is taken--used as direct instructional material;

. sets of questions can be identified and used with other mathematical word problems selected from the classroom curriculum; and

. sets of questions can be selected for use several times during instruction over a semester or year.

Thus, the Mathematics Assessment Questionnaire constitutes a resource as instructional material as well as an assessment tool.

As an assessment tool, the information from the questionnaire can be used to suggest questions for follow-up with students. As with any assessment results, the information needs to be used together with data about students collected from other sources.

The Mathematics Assessment Questionnaire is presently in a paper and pencil format and can be summarized by hand or by a school-developed scanning program. The questionnaire could be adapted to presentation on a microcomputer in labs or classrooms.

General Description

The Mathematics Assessment Questionnaire contains 162 statements and can be completed by most students within one class period (40 minutes). The questionnaire has two sections:

Part I: students solve a non-routine word problem and respond to 20 statements about what they did while solving the problem. These statements ask the students to reflect on and indicate their awareness of their thoughts before, during, and after they worked on the problem. For example, students are asked to indicate if they tried to put the problem in their own words, before they began to solve the problem. Students also indicate if they are aware of using any one of four problem-solving strategies.

The statements in Part I are concerned with the student's "directed cognition"--the self-monitoring processes that are thought to be important in problem-solving. These processes are sometimes called metacognitive as they involve an awareness of cognitive activities during problem solving (Schoenfeld, 1985).

Part II: students respond to statements grouped within three activity settings--1. During Class (whole class) instruction (49 statements); 2. Working With Other Students (54 statements); and 3. Doing Homework, an independent activity (39 statements). Within each activity setting, there are two sets of statements. The first set asks students about what they do when they are working on mathematical word problems within that setting. These "Self-Regulation" statements are grouped like the statements in Part I: What do I do before, during and after a teacher's lesson (During Class), working in a group (Working With Other Students), and working independently (Homework). The statements focus on planning and goal setting (before), monitoring progress and keeping track (during), and judging, evaluating and reviewing (after). An example of a statement students are asked to rate as true or not true is, "I know when the teacher is beginning a new mathematics idea." This is an example of a statement in the During Class setting, at the beginning of a mathematics lesson about word problems.

The second set of statements in each activity setting asks students to reflect on their beliefs and feelings about mathematics word problems. These beliefs and feelings are related to "intentionality" or mathematical dispositions, as identified in the NCTM Standards. In the Mathematics Assessment Questionnaire the constructs (thoughts & feelings) included are:

1. Affective beliefs (4 constructs)--about the utility or value of working mathematics word problems, interest in word problems, confidence or expectation of success, and anxiety or concern about doing word problems;

2. Motivation (2 constructs)--internal learning goals or external performance goals; and

3. Attributions--beliefs (4 constructs) about the causes or reasons for one's success or failure.

Thus, there are 10 thoughts or feelings (constructs) or belief areas within each of the three activity settings.

Overall, with the exception of Part I, working on and reflecting on doing a single word problem, all of the thoughts and feelings are assessed in the context of a classroom activity--During direct, whole group instruction; Working With Other Students in a small group; or Homework, working independently on mathematical word problems. Figure 1.1 provides an overview of the specifications for the full questionnaire. The numbers in the figure are the number of statements for each construct (thought or feeling) in each setting.

Figure 1-1

Specifications for the Mathematics Assessment Questionnaire: Number of Statements for Psychological Constructs and Activity Settings

PSYCHOLOGICAL CONSTRUCT	ACTIVITY SETTING		
	During Class (Teacher-led)	Working With Other Students	Doing Homework
Metacognitive: Solving a math problem			
.before you begin, planning, defining objective, setting goals	20 METACOGNITIVE STATEMENTS LINKED TO ONE NON-ROUTINE PROBLEM		
.as you work, monitoring progress, keeping track			
.after you finish, evaluating, judging			
.strategies employed			
Self-regulation			
.before beginning, planning, defining objective, setting goals	6	7	3
.during the activity, monitoring progress, keeping track	8	8	3
.after the activity, evaluation, judging	5	8	3

PSYCHOLOGICAL CONSTRUCT	ACTIVITY SETTING		
	During Class (Teacher-led)	Working With Other Students	Doing Homework
Affective Beliefs			
.utility, value of math	3	3	3
.interests	3	3	3
.expectancies of success/confidence	3	3	3
.anxiety	3	3	3
Motivations			
.internal learning goals	3	3	3
.external performance goals	3	3	3
Attributions			
.internal stable controllable	3	3	3
.internal stable uncontrollable	3	3	3
.external stable uncontrollable	3	3	3
.unknown control	3	3	3

Views of the Learner and Teacher

The Mathematics Assessment Questionnaire is based on a cognitive-constructivist view of the development of mathematical thinking. The emphasis is on students' direct reflections on their cognitions or thinking and beliefs. The student is viewed as an active, reflective constructor of knowledge in the classroom. The structure of and the selection of statements for the questionnaire are grounded in this view of individual learners in classrooms.

The teacher's role is also viewed from this perspective: Since students have beliefs or reflections on mathematics, it is important for teachers also to understand these beliefs in order to facilitate student development of mathematical knowledge. Students' beliefs occur in several areas. One area is beliefs about mathematics concepts and procedures. For example, a belief about fractions may be that the notions of fractions and decimals are not related to each other as a way of representing numbers. Another area of beliefs is the value or utility of mathematical problem solving. A student may hold the belief that solving word problems in school has no value or utility outside the classroom.

Both of these examples of student beliefs concern how students represent their experiences in mathematics. They are beliefs about how students think about their own mathematical knowledge and knowledge construction processes. The questionnaire is concerned with assessing students' awareness of how problem solving and participation in classroom activities take place, and the affective and motivational beliefs related to these activities.

The Mathematics Assessment Questionnaire does not attempt to assess student beliefs about mathematics as a subject, such as the belief that mathematics problems have only one right answer. It also does not attempt to assess students' beliefs about specific mathematical concepts and procedures. These beliefs are important and also are specific to the local curricula. Such beliefs, e.g., about multiple representations of numbers or procedures for obtaining percents, can be observed and assessed by each teacher through particular students' writings or explanations. They are tied to the time and curricular sequence in each school. The questionnaire beliefs are more general, asking for thoughts, feelings and beliefs about mathematical word problems in a general way, so that students can interpret the statements in the context of the word problems familiar to them in classroom work.

By taking the perspective that students hold beliefs about mathematics--concepts, procedures, cognitive activities in problem solving and learning, and that students have different affects, motivations and attributions about their performance--the stance is taken that knowledge and attitudes are not absolute and objective. Beliefs imply that they are held by individuals--teachers and students, and that both are entitled to a view or an opinion (D. R. Olson, personal communication, January 27, 1988). In essence, students are constructing their beliefs about mathematics, with the assistance of teachers. Olson argues that it is important for students to treat "knowledge" as "beliefs" as one route to developing the capacity to think critically--to reflect on and evaluate knowledge claims.

The teacher's role is concerned with understanding and supporting or changing these beliefs and thinking. The questionnaire embeds the assessment of student beliefs in the context of mathematics classroom activities. Thus, the link to thinking about instructional planning is intended to be direct, since teachers and students think about instruction in terms of their daily classroom activities.

This Manual for Users provides general and detailed descriptions of the questionnaire, relevant background from the research literature and a description of how the questionnaire was developed. It describes approaches to the reporting and uses of the questionnaire. Sample responses from students and classes are also given. The manual and the assessment tool are intended to support the teacher's professional, working knowledge of students and how students develop mathematical thinking.

CHAPTER II

CLASSROOM ACTIVITIES, THOUGHTS AND FEELINGS, AND THE MATHEMATICS ASSESSMENT QUESTIONNAIRE

The Mathematics Assessment Questionnaire is designed to sample student thoughts and feelings in relation to engaging in learning the process of solving mathematical word problems. In Part I of the questionnaire these thoughts or awarenesses are elicited following the working of a nonroutine mathematical word problem. In Part II the thoughts and feelings are elicited in the context of classroom activities. The general structure and categories used in the questionnaire are shown in Figure 1.1, in Chapter I. With the exception of Part I (Metacognitive statements) each statement includes the thought or feeling about mathematical word problems in the context of a classroom activity--Direct Instruction, Working With Other Students, or Doing Homework. In this chapter, definitions and examples of the statements are given.

Directed Cognition: Self-Direction of Learning

Directed cognition is used here as a broad term which encompasses students' awareness of the activities and thinking they carry out when solving a single mathematical word problem (metacognition) and when participating in larger activity settings, such as class lessons given by the teacher, working with others in a group setting, or doing homework independently. In the activity settings, self-regulation is the term used to encompass student awareness of thinking and related activities. Various writers categorize these processes differently, but we have kept the terms metacognition and self-regulation distinct here, in acknowledgement of the focus in mathematics classrooms on individual mathematical problem-solving and on broader activities.

Metacognition

Metacognition refers to knowledge of the cognitive or thinking processes one uses while undertaking cognitive tasks, such as problem-solving (Brown, 1978; Flavell, 1979; Garafalo & Lester, 1985). General categories used in this self-monitoring of problem-solving include planning and goal setting, monitoring progress, and evaluating. In mathematical problem-solving, Schoenfeld (1985) describes competent problem solvers as those who consistently monitor and evaluate their solutions as they work, and he uses episodes or stages to study problem-solving protocols: read, analyze, explore, plan, implement, and verify (1985, p. 294).

In the Mathematics Assessment Questionnaire the statements or prompts to assess student awareness of cognitive activities follow the working of a nonroutine problem that has more than one solution. The problem is the following:

> Eight pennies are arranged in a row on a table. Every other coin is replaced with a nickel. Then, every third coin is replaced with a dime. Finally, every fourth coin is replaced with a quarter. What is the total value of the coins on the table?

The metacognitive prompts to which students respond are ordered according to the general structure of: Before beginning to work, During working the problem and After working the problem. A fourth area is: Strategies used, that is, mathematical problem-solving strategies. Students respond in one of three categories: YES, MAYBE, or NO, to each statement. Examples of statements in each of the four areas are:

- Before you began to solve the problem-What did you do?

  Sample: I read the problem more than once

- As you worked the problem-What did you do?

  Sample: I kept looking back at the problem after I did a step.

- After you finished working the problem-What did you do?

  Sample: I looked back at the problem to see if my answer made sense.

- Did you use any of these ways of working?

  Sample: I drew a picture to help me understand the problem.

The use of a nonroutine problem with more than one solution is critical to eliciting students' awareness of their thinking. When a routine problem is given, students are not challenged and are not as aware of their thinking (see Chapter 3, Table 3-1). The 20 statements or prompts in the metacognitive section provide a starting point to assess student awareness of their activities during mathematical problem-solving. Statements are generic in the sense that they could be used with other problems that are directly linked to mathematics curriculum topics. For example, the statement, "I thought about what information I needed to solve the problem," could be used with a variety of problems.

Self-Regulation

Self-Regulation has received attention in several psychological theories that propose descriptions of the individual's activities involved in learning. In social learning theory, Bandura (1986) proposed a cognitive view of self-regulatory behavior that included subprocesses of self-observation, judgment, and self-reaction. Drawing on another view, Corno and Mandinach (1983) proposed that components of self-regulated learning are alertness, selectivity, connecting, planning, and monitoring, including self-checking. Meichenbaum (1977), in clinical studies of cognitively-oriented behavior modification, has also focused on strategies to help individuals control their own behaviors. Thus from several perspectives the importance of the individual's awareness of activities and thoughts in classroom learning activities is emphasized.

In the Mathematics Assessment Questionnaire the general structure used for the self-regulatory statements parallels the three major categories of Before, During, and After, that are used for the metacognitive statements. This is done on purpose, to provide a consistent framework for students. These categories are used within each of the three classroom activity settings: During Class, Working with Others, and Doing Homework. Sample statements for each activity setting are given below. Students rate how true a statement is for them, on a scale from 1, VERY TRUE, to 5, NOT AT ALL TRUE.

Self-Regulation category sample statements are:

BEFORE

At the beginning of a math lesson

I know when the teacher is giving me practice in new math problems.

Before beginning to solve a word problem
with other students

I try to work the problem by myself first.

Before beginning homework word problems

I decide when is the best time to do
my math homework word problems.

DURING

During a math lesson

I ask my math teacher to explain a problem again that I do not understand.

While working a word problem with other students

I say to the other students if I think something should be worked differently.

While working the homework problems

I make sure I try every problem, even if I cannot solve them all.

AFTER

At the end of a math lesson about word problems

I try to figure out if I need to do more to learn the lesson.

After doing a word problem with other students

I check to see if our calculations are right.

After working the homework word problems

If I cannot do the word problems, I write out all the steps I can do and bring them to class.

As is evident from these statements in the metacognition and self-regulation areas, the student is being asked to reflect on her or his active engagement in solving a problem or participation in a classroom learning activity. Reflection on and taking responsibility for active engagement in classroom activities will increase students' sense of control in learning mathematical concepts and procedures. These reflections and awarenesses are important. Such thinking activities are believed to be fundamentally important to reasoning and thinking critically about knowledge, as is required for successful mathematical problem-solving (Olson, personal communication, 1988).

Intentionality: Thoughts and Feelings About Learning

Thoughts and feelings are also important in learning mathematics and persisting in mathematics (Casserly & Rock, 1985; Eccles, Adler, Futterman, Goff, Kaczala, Meece, Midgley, 1985). The general category of intentionality, will, or the "mathematical dispositions" of students is taken here to include the affective beliefs, motivations, and attributions about learning mathematics held by students. Paris (1988) has provided a persuasive argument that the student's understanding of the value of a skill--memory strategies in his example, is influential in the plans for and use of the skill. Others who have written about the interdependence of performance in mathematics and the learner's attitudes and feelings include McLeod (1988) and McLeod and Adams (1989).

In the Mathematics Assessment Questionnaire individual characteristics related to thoughts and feelings about mathematics have been grouped into three major categories: Affective Beliefs, Motivation, and Attributions (see Figure 1.1). The affective beliefs included here are the perceived value of a mathematically-related activity, interest, confidence, and anxiety or concern over doing a mathematical word problem. Motivations include the perceived reasons for approaching or learning mathematical problem-solving, whether these originate from the individual's own goals for learning or from external sources. Attributions include beliefs the student has about the causes for success or failure in learning or doing a mathematical word problem. Instances in which the individual feels no sense of control about learning or performance outcomes are also considered attributions.

As with the self-regulatory statements, all of the statements to which students respond are given in the context of a classroom activity--During class, Working With Other Students, or Doing homework. Students rate how true a statement is for them, on a scale from 1, VERY TRUE, to 5, NOT AT ALL TRUE.

Affective Beliefs--Value, Interests, Confidence, Anxiety

Value. Value refers here to the conviction that learning about mathematical word problems in school is worthwhile, useful, or important. The statements about value are given in the context of one of the three activity settings. An example for the During class setting is:

. Even when I listen to my teacher, I cannot understand how learning to solve word problems will help me in my everyday life.

Students who agree that the statement is VERY TRUE or TRUE, are providing one indicator that they see little value or link between classroom experiences in mathematics and their outside world.

Interests. Interests can be defined as topics or subjects that hold the learner's attention or arouse feelings of curiosity, eagerness, liking or enjoyment. The negative aspects, that is disinterest, would be indicated by lack of curiosity, active disliking, or boredom. While not often assessed outside of career and occupational instruments, interest in mathematics and mathematical topics is a concern of teachers. An example of an Interest statement in the Working with Others setting is:

. I would find math interesting if I worked on a word problem with a group of students.

Interests are another source of motivation in learning, particularly when linked to occupational requirements. Students are often unaware of the extensive use of mathematics in many occupations.

Confidence. Confidence or expectations for success can be defined as a belief in one's own ability to do a task or learn a topic. An example is the belief that one can successfully solve a mathematical problem. Measures of expectancies are related to achievement and intention to take additional mathematics courses (Eccles et al., 1983). An example in the Homework setting is the following statement:

. I never expect to be able to do the types of word problems I get for homework.

Lack of confidence may be realistic, when mathematical skills are poor, and unrealistic when mathematical performance is high. Student responses to the Confidence statements provide information that can be helpful in understanding student beliefs about their performance in solving mathematical word problems.

Anxiety. Anxiety can be defined as a state of worry, uneasiness or fear about one's performance on a task or area of endeavor. A lack of anxiety is indicated by a state of relaxation, a lack of concern, and a feeling of comfortableness while working mathematical word problems. Anxiety is assessed here in the context of doing or learning about mathematical problem-solving in one of the three activity settings. An example of a statement in the During Class setting is:

. I am afraid when I have to ask my math teacher a question about a word problem during class.

Anxiety is not necessarily a problem in some circumstances: we know that a moderate amount is facilitating-- encouraging studying for tests, for example. For students who mark this type of statement VERY TRUE, however, learning may be hindered by not actively engaging in the classroom lesson. The response provides an indicator or raises a question that can be followed up with a student.

Motivations--Learning and Performance Goals

Motivation is concerned with the causes of goal oriented activity (Dweck, 1986). According to Dweck (1986):

> Achievement motivation involves a particular class of goals--those involving competence--and these goals appear to fall into two classes: (a) learning goals, in which individuals seek to increase their competence, to understand or master something new, and (b) performance goals, in which individuals seek to gain favorable judgment of their competence or avoid negative judgments of their competence....(p. 1040).

In general, learning goals are intrinsic for the individual and emphasize learning because it is personally challenging and personally valued. Performance goals are extrinsically based and emphasize learning motivated by influences outside the individual, i.e., motivation based on grades or teacher approval.

In the Mathematics Assessment Questionnaire the indicators of motivation used are statements that assess learning or performance goals. An example of each type is given below. Students indicate how true a statement is for them on the scale of 1, VERY TRUE, to 5, NOT AT ALL TRUE.

Internal Learning Goal: Working with Others Setting

- I would work hard on a word problem with other students because it would help me to understand how to do the problems.

External Performance Goal: Homework Setting

- The only reason I would do extra homework problems is if I could get extra credit.

Students who indicate that statements such as these are true for them are likely to differ in their reasons for learning. A long-term educational goal is to support the development of active mathematics learners and persistent problem solvers, who believe that learning is of intrinsic benefit to them. Responses to statements such as these provide an opportunity to assess motivation-related beliefs, and to consider the structure of classroom activities and rewards (discussed in Chapter 4).

Attributions--Causes of Successful and Unsuccessful Performance, Unknown Control

There are important sets of beliefs related to mathematics achievement and taking more mathematics courses that are labelled "attributions." These beliefs are also related to motivation and the emotional or affective feelings students have toward mathematics. The particular attribution theory that guided the writing of the statements in the questionnaire is that of Weiner (1986).

Weiner suggests that three dimensions are important in understanding an individual student's logic of analysis or beliefs about what causes the student to succeed or fail in tasks such as mathematical problem-solving. The perceived causes of failure or success can be classified according to their locus of control, stability, and controllability. Locus of control concerns whether an individual attributes success or failure to personal or environment causes. The stability dimension refers to whether the cause is seen as changeable or unchangeable. The third dimension, controllability, addresses whether or not the cause for success or failure is perceived to be within the individual's influence.

Although Weiner has a set of eight categories based on the three dimensions, a smaller number of categories have been selected for use here. In the Mathematics Assessment Questionnaire four classifications of perceived causes of success or failure have been used. Again, students give their rating of how true the statement is for them on the scale 1, VERY TRUE, to 5, NOT AT ALL TRUE. Examples of the statements are given for each of the categories.

. Internal Stable Uncontrollable: During Class Setting

> If I can follow my teacher's explanation for word problems, it is because I am smart.

The student who agrees that this statement is VERY TRUE, may be indicating a set of beliefs about how and why he or she achieves. The causal factors in success are perceived to be internal, the self; are perceived to be stable, smart = ability, something that doesn't change; and uncontrollable, ability is not something the student has control over. You cannot change how smart you are. Contrast this set of beliefs with the next example.

. Internal Stable Controllable: Working With Other Students Setting

> If I cannot solve a word problem with other students, it is because we did not try as hard as we could on the problem.

The student who agrees with this statement may be indicating a set of beliefs about causes of failure as follows: the causal factor in failure is internal, in the students; the cause is stable, hard work; and yet the cause is controllable, "we didn't try as hard as we could." Students who attribute success and failure to something they can do or not do, and that is controllable by them, have a set of beliefs that should facilitate learning. These beliefs can be contrasted with those in the third category:

. External Stable Uncontrollable: Homework Setting

> If I am unable to do homework word problems, it is because the math book is confusing.

The student who agrees with this statement may be indicating beliefs that the causal factor in failure is external to the student--the math book; the cause is stable, a book; and the cause is uncontrollable, the student cannot change the mathematics textbook. Again, there is a set of causal beliefs about student failure that does not put the responsibility for the failure with the student. Yet, this student does have some set of beliefs about why success or failure occurs. Contrast this statement with the next category, unknown control.

. Unknown Control: During Class Setting

> I usually do not know what is going on when my teacher is explaining a word problem.

In this fourth category of attribution there is a perceived confusion and inability to make sense out of causality. Following Connell (1985), in Unknown Control students may be saying that they do not know why these learning outcomes occur. They indicate a lack of knowledge about the locus or source of causality. Other examples that students might use are, "If I get a bad grade in school, I usually don't understand why I got it" (Connell, 1985, p. 1022).

The first three attribution or causal categories above were selected because they provide a contrast for students and teachers on two central dimensions: The internal-external locus of causality; and the perception of the cause as controllable or uncontrollable. Depending on student responses, teachers can intervene by structuring activities to provide positive achievement experiences so that the student derives success based upon her or his own efforts. Another intervention is providing opportunities for student self-awareness of these perceived causes of achievement success. With the unknown control category, students need opportunities to succeed and to talk about the success as due to their efforts.

In summary, student responses to statements in these four categories may be useful in understanding how students attribute the causes of their successes and failures in mathematical problem-solving.

Overall, the statements in the Mathematics Assessment Questionnaire are based on specific psychological constructs (thoughts and feelings) and embedded in classroom activity settings for the purpose of providing examples of student responses that will assist in understanding the context in which performance of mathematical problem-solving occurs. Mathematical problem-solving occurs in the context of student thoughts, feelings and beliefs, and in the social context of classroom activity settings.

CHAPTER III

DEVELOPMENT AND APPROACHES TO USE

In this chapter the development of the Mathematics Assessment Questionnaire is described. The development was concerned with the meaning of the statements to students and the potential use of the statements by teachers. Because of the emphasis on the use of the questionnaire, there has been an effort to consider in what form the information from student responses may be most useful to teachers. In conjunction with teachers, various groupings of statements and types of reports have been examined, and these are described here.

Development Studies

The development studies for the Mathematics Assessment Questionnaire began in 1986-87. During that year the feasibility of the assessment tool was examined by reviewing the research and literature related to mathematics and attitudes, cognitive processes, motivation, and related concepts. This work was followed by the writing of sample statements, in the context of classroom activities. Experienced teachers of mathematics discussed and evaluated the statements for their usefulness for instructional planning. Sixteen experienced mathematics teachers and mathematics teacher educators from the New York City area volunteered to attend a one-day meeting for the purpose of this evaluation. The responses were generally positive. Teachers indicated that the sample statements would provide information about students that was important in learning mathematics, information that is not currently available in standardized tests. Teacher ratings also indicated that student responses to the statements would provide information useful in planning instruction.

The next stage in development took place during the 1987-88 year. During this period a series of small-scale studies were conducted to address the following questions:

1. Were the metacognitive statements meaningful to students?

This question was answered by trying out the questions with several classes. Students were asked to indicate if they did not understand or questioned any of the statements. Four teachers and four teacher educators also reviewed the statements. Individual interviews with students used the "think aloud" procedure, and also asked students how they would say the same statement to classmates, using their own words.

2. Does it make any difference what type of problem is used for the metacognitive statements?

A study was conducted in 1987-88 comparing student responses on the metacognitive statements to two different mathematics problems. One problem was the nonroutine coin problem presented in Chapter 2. The other problem was this routine problem:

> You spent $2.50 on cookies and three times as much on other food. How much change did you receive if you paid with a 20 dollar bill?

Students solved one of the two problems, then responded to the metacognitive statements. One hundred five students worked the coin problem and 92 students worked the change problem. Students were in grades 7 or 8, in three schools.

The problems and statements were administered randomly within classrooms, so essentially equivalent groups of students responded to the statements following each problem. The data in Table 3-1 show that different questions elicit different awareness of cognitive activity on the part of students. For example, the coin problem is a nonroutine problem, and has more than one answer. Statement 4 shows that students who worked the coin problem reported that they tried to put the problem in their own words more frequently than students who worked the change problem.

A comparison was made of students' perceptions of the two problems on several ratings. Table 3-2 indicates that students found the non-routine coin problem somewhat more difficult, liked it somewhat less, and were less relaxed when working the problem.

Based on this study the coin problem was selected for the questionnaire. The results indicate the importance of providing students with opportunities to apply their mathematical skills to problems that are challenging and that encourage the view that problems can be solved in more than one way and can have more than one answer.

3. Does it make any difference whether statements have different levels of specificity about mathematics?

Existing measures of mathematics anxiety, confidence, value and utility typically ask students to respond to the general term, "mathematics" or "math." Because the Mathematics Assessment Questionnaire is intended to be useful for classroom instructional purposes, a study was designed to examine the effect of using different levels of specificity about mathematics. Would student responses be affected by using the term "mathematics" vs. "mathematics

TABLE 3-1

Percentage of Students Who Responded YES, MAYBE or NO to the Metacognitive Statements After Working One of Two Different Word Problems

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Problem A1: Eight pennies are arranged in a row on a table. Every other coin is replaced with a nickel. Then, every third coin is replaced with a dime. Finally, every fourth coin is replaced with quarter. What is the total value of the coins on the table?

Problem A2: You spent $2.50 on cookies and three times as much on other food. How much change did you receive if you paid with a 20 dollar bill.

Directions: First solve the problem. Then turn the page and answer the statements about what you thought and did.

BEFORE YOU BEGAN TO SOLVE THE PROBLEM - WHAT DID YOU DO?

		YES	MAYBE	NO	
1. I read the numbers and symbols first, then I read the words.	A1:	21%	24%	55%	(N=104)
	A2:	15%	18%	67%	(N= 91)
2. I read the entire problem.	A1:	94%	2%	4%	(N=104)
	A2:	95%	3%	2%	(N= 92)
3. I thought to myself, Do I understand what the question is asking me?	A1:	68%	22%	10%	(N=105)
	A2:	61%	17%	22%	(N= 92)
4. I tried to put the problem into my own words.	A1:	45%	25%	30%	(N=105)
	A2:	26%	25%	49%	(N= 92)
5. I read the problem more than once.	A1:	86%	8%	6%	(N=104)
	A2:	76%	9%	15%	(N= 92)
6. I asked myself, Do I know how to do this problem?	A1:	55%	27%	18%	(N=101)
	A2:	44%	18%	38%	(N= 90)
7. I tried to remember if I had worked a problem like this before.	A1:	36%	15%	49%	(N=105)
	A2:	30%	20%	50%	(N= 92)
8. I thought about what information I needed to solve this problem.	A1:	76%	13%	11%	(N=105)
	A2:	70%	20%	10%	(N= 92)
9. I asked myself, Do I have enough information to solve this problem?	A1:	39%	32%	29%	(N=104)
	A2:	41%	19%	41%	(N= 91)

TABLE 3-1 (continued)

		YES	MAYBE	NO	
10. I asked myself, Is there information in this problem that I don't need?	A1:	22%	23%	55%	(N=104)
	A2:	17%	21%	62%	(N= 92)
11. I picked out the operations I needed to do this problem.	A1:	65%	19%	16%	(N=104)
	A2:	71%	15%	14%	(N= 92)
12. I felt confused and could not decide what to do.	A1:	28%	33%	39%	(N=105)
	A2:	16%	16%	67%	(N= 92)
13. I drew a picture to help me understand the problem?	A1:	48%	9%	43%	(N=105)
	A2:	6%	11%	83%	(N= 92)
AS YOU WORKED THE PROBLEM - WHAT DID YOU DO?					
14. I wrote out all the steps as I worked the problem.	A1:	52%	18%	30%	(N=100)
	A2:	52%	15%	34%	(N= 89)
15. I kept looking back at the problem after I did a step.	A1:	77%	8%	15%	(N= 99)
	A2:	53%	16%	31%	(N= 89)
16. I had to stop and rethink a step I had already done.	A1:	42%	27%	31%	(N=100)
	A2:	42%	15%	44%	(N= 89)
17. I checked my work step-by-step as I worked the problem.	A1:	67%	18%	15%	(N=100)
	A2:	61%	14%	25%	(N= 88)
18. I did something wrong and had to re-do my step(s).	A1:	40%	20%	40%	(N=100)
	A2:	24%	17%	60%	(N= 89)
19. I looked back to see if I did the correct calculation.	A1:	77%	13%	9%	(N= 97)
	A2:	74%	10%	16%	(N= 89)
20. I checked to see if my calculations were correct.	A1:	74%	14%	12%	(N= 98)
	A2:	81%	7%	12%	(N= 88)
21. After I did the problem I went back and checked it all again.	A1:	48%	27%	25%	(N= 98)
	A2:	51%	21%	29%	(N= 87)
22. I stopped before I got an answer to this problem.	A1:	24%	27%	49%	(N= 97)
	A2:	20%	20%	60%	(N= 89)
23. When I got my answer, I looked back at the problem to see if my answer made sense.	A1:	74%	15%	11%	(N= 99)
	A2:	64%	15%	21%	(N= 89)

Note. Percentages do not always sum to 100 due to rounding.
A1: Non-routine coin word problem.
A2: Routine money-change word problem.

TABLE 3-2

Percentage of Students Indicating Liking, Difficulty and Nervousness After Working One of Two Word Problems

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Problem A1: Eight pennies are arranged in a row on a table. Every other coin is replaced with a nickel. Then, every third coin is replaced with a dime. Finally, every fourth coin is replaced with quarter. What is the total value of the coins on the table?

Problem A2: You spent $2.50 on cookies and three times as much on other food. How much change did you receive if you paid with a 20 dollar bill.

How much did you like doing the problem?

	A1 (N=96)	A2 (N=88)
liked it very much	15%	22%
sort of liked it	43%	49%
sort of disliked it	23%	24%
dislike it very much	20%	6%

How easy or hard was it for you to do?

	A1 (N=105)	A2 (N=92)
very easy	20%	34%
easy	50%	56%
hard	28%	8%
very hard	3%	2%

How relaxed or nervous did you feel when you did this problem?

	A1 (N=105)	A2 (N=92)
very relaxed	40%	52%
sort of relaxed	32%	35%
sort of nervous	25%	10%
very nervous	3%	2%

Note. Percentages do not always sum to 100 due to rounding.
A1: Non-routine coin word problem.
A2: Routine money-change word problem.

word problems" vs. a verbal description of a word problem vs. a particular word problem?

To answer this question statements with differing levels of content specificity were randomly administered in February 1988, to students within each of eight mathematics classes (grades 7 and 8) from three public schools in New York City. The statements were presented on two forms which differed only in the wording of the most specific item. The most specific item on Form 1 provided a verbal description of a word problem, while the most specific item on Form 2 included an example of a word problem. Students indicated how true each statement was for them on the scale: 1, VERY TRUE, to 5, NOT AT ALL TRUE. Table 3-2 presents the results for statements about Anxiety and Confidence, written at different levels of specificity. The percentages in the table represent the students responding VERY TRUE plus TRUE in Example 1 and VERY TRUE in Example 2.

As shown in Table 3-3, student responses will vary according to the level of specificity at which statements about mathematics are written. Perhaps the most dramatic shift is shown for the Confidence statements, Example 2. There students expressed less confidence when asked about learning to do math homework problems described in words, than they did when they were actually given a problem. Further, there is in each example a difference between the general term, math, and the term, math word problems. Because math word problems is at a more specific level, and because of the emphasis on applications to mathematical word problems, this level of specificity was used in the questionnaire. When questionnaire statements are used in individual classrooms, it would be possible to vary their use by examining student responses when specific problems are given, as they were in this study. That is, specific problems can be used, instead of the term--math word problem, in the affective belief statements.

After these series of studies were completed, a large set of statements was written. Over three hundred statements were tried out in the spring of 1988. The statements were printed in three booklets, administered randomly within classrooms, in grades 7-9 in 14 New York City public schools and one parochial school. Approximately 1500 students participated in this pilot administration. The description of the major analyses of these data are given in the Technical Report for the Mathematics Assessment Questionnaire (Hecht & Tittle, 1990).

Following the analyses, a smaller set of 162 statements was selected to form the present booklet for the Mathematics Assessment Questionnaire. The Mathematics Assessment Questionnaire has been administered to approximately 2,000

TABLE 3-3

Percentage of Students Responding TRUE and/or VERY TRUE to Statements Varied in Level of Specificity for two Constructs: Anxiety and Confidence

EXAMPLE 1: ANXIETY

General:	I worry when I have to do math.
Specific:	I worry when I have to do math word problems for homework.
Very Specific: (words)	I worry when I have to do math word problems where I must multiply fractions for homework. (Form 1 only)
Very Specific: (example)	I worry when I have to do math word problems like this for homework: The traffic light changes every 20 seconds. How many times will it change in 1-1/2 hours? (Form 2 only)

Level of Specificity	Form 1	Form 2
	(n=105)	(n=104)
General:	31%	31%
Specific:	20%	17%
Very Specific: (word)	35%	-
Very Specific: (example)	-	40%

Percentages indicate students responding VERY TRUE and TRUE

TABLE 3-3 (continued)

EXAMPLE 2: CONFIDENCE

General:	I know I can learn to do most math problems.
Specific:	I know I can learn to do most math homework problems which involve word problems.
Very Specific: (words)	I know I can learn to do most math homework problems which involve word problems with several addition steps. (Form 1 only)
Very Specific: (example)	I know I can learn to do most math homework problems like this: A softball team won 15 games, It lost 3 more than it won. How many games has the team played? (Form 2 only)

Level of Specificity:	Form 1	Form 2
	(n=105)	(n=104)
General:	71%	74%
Specific:	53%	54%
Very Specific: (words)	47%	-
Very Specific: (example)	-	72%

Percentages indicate students responding VERY TRUE students in eight New York City public schools. The criteria for selecting students and classes was that students read at the seventh grade level, and that classes not be at the very top (gifted) or very bottom (low remedial) of the mathematics sections in a school. There are complete responses to the questionnaire for 1700 students, across grades 7-9.

The analyses showed little consistent differences between grades on the responses to statements. As a result, the responses to statements were combined for all three grades. Appendix 3-1 presents the percents responding to each of the 162 statements for the total sample of students with complete data. Data on internal consistency reliability and other statistical characteristics of the Mathematics Assessment Questionnaire are given in the Technical Report (Hecht & Tittle, 1990).

Approaches to Use

The statements of the Mathematics Assessment Questionnaire have been written to provide information for classroom instructional planning. With the exception of the metacognitive activity statements, the information about students' thoughts and feelings about mathematical word problems is embedded in statements in two ways: 1) the thinking/feeling characteristic and 2) the classroom activity setting. These two facets of each statement mean that student perceptions and beliefs about their thoughts and feelings can be examined in more than one way. For example, responses across settings for the same category can be compared, such as Interest in mathematical word problems while working homework problems or working in a group. Different categories within the same setting can also be compared. For example, Value can be compared to Confidence when working with other students. Both types of comparisons may provide useful information about a student or group of students.

In this section the approaches to examining student responses are described for the Directed cognition statements--metacognitive and self-regulatory statements, and for the Intentionality statements--affective, motivational, and attributional thoughts and feelings.

Directed Cognition

The approach taken to examining student responses in the metacognitive and self-regulatory categories is at the individual statement level. These statements have NOT been summed for a total "metacognitive" or "self-regulatory" score because of the characteristics of the statements and of the characteristics of student responses to the statements. For both sections the statements have been organized or grouped into logical units of Before, During, and After the activity (solving an individual problem, During a class lesson, Working with other students, or Homework). The reasons for examining only responses to individual statements are as follows:

. Although the Before, During, and After units are logical, we know that in the actual processes students will work back and forth among the thinking activities. This has been described for the metacognitive activities in a group problem-solving setting (Artzt and Armour-Thomas,1990) and for individual problem solvers (Schoenfeld, 1985).

. For the metacognitive statements, some activities are more likely to be used or are more appropriate for some problems than for others. Teacher ratings of the appropriateness of the statements for the coin problem, for example, will vary. (See Appendix 3-2 for preliminary results.)

. The use of the statements or prompts in these sections results in obtaining student reflections about these processes, rather than obtaining more direct observation of students at work or thinking aloud during the working process.

The statements thus impose a particular structure on student responses, and it is not justifiable to summarize the responses for any of the sections to obtain a total score for a student or a mean score for a class. This conclusion is supported by statistical analyses of the statements and student responses, which indicate that there is not a single factor or dimension underlying the groups of statements. The Technical Report (Hecht & Tittle, 1990) provides further information.

In the examples for classroom use given in Chapter IV the metacognitive and self-regulatory statements are always examined individually. Thus, a response pattern for an individual student is illustrated, and might look like this:

> John's responses to statements about what he did while working a mathematical word problem:

BEFORE YOU WORKED THE PROBLEM	NO	MAYBE	YES
1. I read the problem more than once	*		
2. I thought to myself, Do I understand what the question is asking me?		*	
3. I tried to put the problem into my own words.	*		
4. I tried to remember if I had worked a problem like this before.			*

Without having all of John's responses, a picture is starting to emerge of a student who is relying on a particular strategy--working a problem like this before--, perhaps without trying to read and understand the coin problem. Discussions with John, observations of his work, or use of a think-aloud procedure--asking him to talk-aloud while he is working a problem like the coin problem--can be used to check out this hypothesis.

A summary of the responses to the same four statements by all the students in a class yielded the following:

BEFORE YOU BEGAN TO SOLVE THE PROBLEM--WHAT DID YOU DO?	percentage answering		
	NO	MAYBE	YES
1. I read the problem more than once.	4	21	75
2. I thought to myself, Do I understand what the question is asking me?	12	25	63
3. I tried to put the problem into my own words.	38	25	37
4. I tried to remember if I had worked a problem like this before.	42	18	40

These (actual) class results could lead to a lesson on reading word problems, as it did for one teacher in a New

York City school. Twenty-five percent of the seventh grade students said No or Maybe, to statement 1. In trying to understand these students' responses, the teacher considered these questions. Did the students think that reading a problem was like reading a novel? Was it a lack of awareness about their thinking or cognitive activities? Were they looking for key words to tell them operations, but found only one, and got confused about what to do? The lesson which resulted never asked the students to solve a word problem. Instead, the students read a problem, determined the main ideas, collected data from the problem, and determined a method of solution. The focus was drawn away from the problem solution and instead emphasized the cognitive activities and strategies needed to solve the problem.

In summary, the approach to describing student responses to the Mathematics Assessment Questionnaire for the metacognitive and self-regulatory statements is on an individual statement basis. Further examples of individual and class responses and uses are given in Chapter IV.

Intentionality: Criterion-Referenced Approach

The approach taken to examining student responses to the statements that underlie students' intentions--affective, motivational and attributional beliefs and feelings--incorporates the individual statement approach and a diagnostic indicator approach. The first approach has been illustrated above, using individual statements to develop hypotheses, and to check them against other information about students' cognitive thinking.

The second approach is similar to that used in criterion or objectives-referenced sets of questions in achievement testing. A cluster of questions is identified for a particular mathematics topic, say fractions, and scoring is based on the number of questions the student answers correctly in that set. A criterion is set--the number of questions that must be answered correctly to decide that a student understands the topic. A criterion may be 3 of 4 questions correct, 5 of 6, and so on. When the criterion is not reached, the information is taken as indicating a need for instructional action. A similar approach has been taken to the 3-statement sets in this part of the questionnaire.

A goal of the approach here is to summarize the data in a way that will be useful for thinking about instructional planning, without assigning scores. It was decided to establish a criterion that would facilitate identifying students whose responses indicated a need for follow-up. The follow-up would check out whether the criterion referenced type "score" or indicator was supported and if there was need for instructional planning to facilitate student development of alternative thoughts and feelings.

The criterion used here is that at least two of three statement responses are in a direction indicating a need for follow-up. Since responses to the statements are on a scale from 1, VERY TRUE, to 5, NOT AT ALL TRUE, a decision was made to use the two extreme categories at the designated end of the scale together. In a sense, the responses to each statement are dichotomized, with the two extreme categories that indicate a need in one set, and the others in another set.

For example, a student's responses to the three statements for Value in the During Class setting are as follows:

VALUE of working mathematical word problems

DURING TEACHER INSTRUCTION

How true is this for you?

	1 Very True	2 True	3 Sort of T	4 Not Very	5 Not at all T
It is important to learn to do the types of word problems my teacher explains in class.					**
Listening to my math teacher explain word problems during class helps me see how important math is.		**			
Even when I listen to my teacher I cannot understand how learning to solve word problems will help me in my everyday life.	**				

The pattern of responses meet the criterion of two of three statements with responses in the need category. Here the first and third statements use the ends of the scale, as indicating a need for follow up. The first and third statements are worded in a positive and negative direction, respectively.

Viewing these results, a teacher could check whether the same pattern appears for Valuing mathematical problems in the other two settings--Working with Other Students and Homework. It would be worthwhile to check if this is true for other types of mathematical work. One classroom strategy may be to find examples of word problems that are related to the student's everyday life; another might be to have the student write word problems based on situations in her/his everyday life.

To facilitate the use of these diagnostic indicators, Appendix 3-3 provides a list of the statement numbers for each category and the direction in which they are counted to determine whether they meet the criterion of need.

Where students meet the criterion of the need indicator for two or more statements, the general interpretation will be:

Affective categories:

low Value
low Interest
low Confidence
high Anxiety

Motivational categories:

not motivated by Internal Learning Goals
motivated by External Learning Goals

Attributional categories:

attributed success or failure to causes that were

Internal Stable Uncontrollable (low ability)
External Stable Uncontrollable (hard textbook)

did not attribute success or failure to causes that were

Internal Stable Controllable (effort)

did not attribute a cause--was confused about cause

Unknown Control

As these general interpretations show, the indicators are designed to identify students with response patterns that suggest a need for intervention. The use of a criterion based on specific response patterns provides a direct meaning for interpretation. If the scale numbers are directly summed into scores, there is no direct meaning since the individuals with extreme scores can merge with individuals in the middle of the score scale. The Technical Manual (Hecht & Tittle, 1990) provides information on the internal consistency reliability (coefficient alpha) for both the criterion score and the summed score. The reliabilities are fairly comparable. Thus, the criterion score and the indicator of need are used, providing a direct interpretation in the form of a hypothesis to be followed up with instructional activities.

CHAPTER IV

CLASSROOM USE: ASSESSMENT AND INSTRUCTIONAL PLANNING

The Mathematics Assessment Questionnaire is designed to have meaning for students and teachers in mathematics classrooms. The use of the questionnaire is based on its initial design: to provide information about student beliefs, thoughts, and feelings about learning and doing mathematical word problems in three classroom activities--During teacher-directed lessons, Working with other students, and Homework. The questionnaire design encourages examining responses to statements by individual students or a class.

In this chapter various means of administering the Mathematics Assessment Questionnaire are described, and examples of techniques for summarizing information are provided. These are followed by suggestions for classroom instructional activities. The suggestions are intended to stimulate further ideas, not to be taken as the only or the best activities to be tried out. Unless otherwise indicated, these activities are based on the suggestions of experienced mathematics teachers.

Administration

The Mathematics Assessment Questionnaire is designed to be administered in one class period, approximately 40 minutes. About 80% of the students will complete the form in this time. Some students will complete the form earlier, and some will not have enough time. Depending on the particular class, the questionnaire could be administered over two days. Among other possibilities for administering and using the questionnaire are:

. administer Part I separately from Part II. Or, administer Part I, then administer each activity setting separately, taking several days and brief times, about 15 minutes, each day. For example, use Part I, then use the During Class statements on one day, followed later by the Working with Others and Homework statements, all from Part II.

. as an alternative to formal administration and summarizing the results for the class, use sections of the questionnaire on different days, and encourage student discussion on each day, in small groups. Alternatively, hold the discussion with the whole class. This strategy may be most useful with the metacognitive and self-regulatory statements.

Each of these suggestions is intended to emphasize the use of the Mathematics Assessment Questionnaire for instructional purposes. The questionnaire is not a standardized test, with strict time limits and a small number of scores. Responses of individual students should be examined for patterns and discussed with the students, to obtain other information and to put the questionnaire responses in a broader context.

Class Summaries

In Chapter III the criterion-referenced approach to use of the Mathematics Assessment Questionnaire was described. That description focused on the definitions and how to interpret the individual student responses for the basic information in the Mathematics Assessment Questionnaire. One of the main ways to use the questionnaire is by examining individual students' responses to the statements in each category. Another way to use the questionnaire is by summarizing the responses to statements for all of the students in the class. This approach can help to focus instructional planning on particular statements or categories. Other ways to examine class results are shown in the next section, Sample Report Forms and Use.

Class summaries can be obtained in several ways:

- by teacher tallying
- by using the class-count method, where students raise their hands for each statement and rating, and the hands are counted and recorded
- by using a separate, standard scanning sheet and a computer program to summarize and organize the results, depending on the school facilities.

The class summaries for Part I, metacognition, and for the self-regulatory statements are obtained by direct counts of all students' responses to each statement. The counts for each statement can then be examined to check whether there are some statements which indicate the need for instructional activities. In Figure 4-1 the counts for statements 14, 15, and 16 in Part I are given for an eighth grade class. In these statements students were reflecting on their awareness of cognitive activities after they worked the nonroutine coin problem.

For this class only five students indicated that they thought about a different way to solve the problem, Statement 16. The remaining, majority, of the students did not think about another way to solve the problem. This may have been because of a lack of time, when the full questionnaire was administered. Alternatively, this may

Figure 4-1

Tally of an Eighth-Grade Class for Selected Metacognitive and Self-Regulatory Statements

	Student Response			
METACOGNITION	NO	MAYBE	YES	NO RESPONSE
14. I went back and checked my work again.	卌 |||	||	卌 卌 卌	0
15. I looked back at the problem to see if my answer made sense.	|||	卌 |||	卌 卌 ||||	0
16. I thought about a different way to solve the problem.	卌 卌 卌 |	||||	卌	0

	Student Response					
Self-Regulation: During Class	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE	NO RESPONSE
11. When my teacher makes a mistake, I say something about the error.	||||	||| 卌	|||| 卌	|	|||	0
12. I ask my teacher to explain a problem again that I do not understand.	||| 卌	卌	|||| 卌	|||	0	0
13. When I can think of another way to solve a word problem, I volunteer to show the class.	||	|||	|||	卌 |||	卌 ||||	0

have occurred because students do not have a curiosity about whether there is another way to solve a problem. Another question to be checked is whether the majority of the students believe that all mathematical problems only have one way to solve them and only one answer. To help students change these beliefs, other problems can be given, problems where there is more than one answer and where there are several procedures that can be used in the problem-solving process.

Figure 4-1 also shows three statements for self-regulation, taken from the During Class activity section: statements 11, 12, and 13. For statements 11 and 12 about half the class agrees that they say something if the teacher makes a mistake and that they will ask the teacher to explain again a problem they don't understand. For the other students who do not agree with the statements, it may be helpful to explore with the class the importance of active participation in their own learning. Strategies may include making a game of teacher mistakes, with groups formed to help individual students get support from their peers for locating "errors."

For statement 13, different strategies may be required, for example, strategies that emphasize presenting word problems that have several forms of solution. Again, student groups may be helpful, with each student in a small group describing her or his solution process to the others.

For the remaining statements in Part II, affect, motivation, and attributions, the responses can be directly counted for each statement, as described earlier. The statements for each characteristic, such as Interest or Value, can be reviewed together. Appendix 4-1 has the complete questionnaire, with the classification category for each statement.

Another approach to class summaries for the categories of Part II is to develop the need criteria for the clusters of three statements (the criterion for need system is given in Appendix 3-3). Hand tally forms that can be reproduced and used for all the questionnaire statements are given in Appendix 4-2.

An example of a class hand tally for statements is given in Figure 4-2 for a construct in each activity section of the questionnaire. As can be seen, these provide extensive information for planning.

The information for planning in During Class, statements 22, 37, and 41, arises from the perspective on the students' beliefs about the causes of successful performance during class. These three statements are intended to examine students' beliefs about whether success

Figure 4-2

Tally of an Eighth-Grade Class for Selected Attribution, Motivation and Affective Categories

Setting: Thought or Feeling	Student Response					
	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE	NO RESPONSE
DURING CLASS SETTING: INTERNAL STABLE UNCONTROLLABLE:						
22. If I correctly answer a question my teacher asks about word problems, it is because I have the ability to learn math.	𝍸 𝍸	𝍸 ||	|||	|||	|	|
37. If I can follow my teacher's explanation for word problems, it is because I am smart.	||	||||	||| 𝍸	||| 𝍸	||	|
41. If I can solve a word problem the teacher puts on the board, it is because I think mathematically.	||	|||	|||| 𝍸	𝍸	𝍸	0
WORKING WITH OTHER STUDENTS SETTING: EXTERNAL PERFORMANCE GOALS						
37. I would work on a word problem with other students only if my friends told me I should.	0	|||	|	𝍸 |	𝍸 𝍸	||||
43. I would work on a word problem with other students only if I could get a better math grade.	|||	||||	𝍸	|||	||||	𝍸
53. I would work on a word problem with other students only if I was told to by my teacher.	|||	||||	𝍸	|||	𝍸 |	||||
HOMEWORK SETTING: INTEREST						
18. I like working on math homework word problems.	0	𝍸 |	𝍸 ||	𝍸	𝍸 ||	0
28. The math word problems I get for homework are interesting to me.	0	||	𝍸 | 𝍸	𝍸 ||	𝍸	0
34. Working on word problems for homework is very boring.	|||	|	𝍸 ||	𝍸 ||||	𝍸	0

is due to an internal cause, themselves, that it is stable and doesn't change (ability, smart, think mathematically), and that it is uncontrollable (ability, being smart and thinking mathematically are characteristics over which students have no control). These beliefs tend to interfere with persistence of effort in school, such as would be needed in mathematical problem-solving.

Interventions focus on changing the beliefs, drawing students' attention to situations in which they do succeed and encouraging attribution to effort--an attribution that is under student control. In this class there appears to be a group of students who attribute their success to these unchangeable, uncontrollable abilities. These are the six students who answer VERY TRUE and TRUE to statements 37 and 41. It may help these students also to focus clearly on why they succeed or fail in school or out of school. Ability is necessary but not sufficient for success.

In the second section of Figure 4-2, three statements from the Working with Others activity setting are given, 37, 43, and 53. These statements are categorized as indicators of a source of motivation, specifically External Performance Goals. In Chapter II motivation was described as the causes of goal-oriented activity. These goals had two causes: learning goals, where individuals seek to improve their competence; and performance goals, where individuals seek to get favorable judgment of competence or avoid negative judgments. These categories again describe student beliefs in relation to school outcomes in mathematics, here in the setting of working on solving mathematical problems with other students.

In reviewing the tallies for the three statements, there is a group of from 7 to 12 students who appear to believe that they seek to do well only because of grades or teacher approval (statements 43 and 53). Assuming that one of the goals of education is for students to internalize the need for learning on their own, and that the goal of learning is to improve their competence and not win the approval of the teacher, intervention strategies may focus in several areas. One area is to examine the use of the classroom reward system, and another is to examine the amount of choice students have in initiating learning activities in class. Classroom reward systems often are uniform for all students, that is students do the same problems at the same pace. Alternative reward plans provide for some flexibility and some student determination of their own learning goals. Encouraging student initiative supports independent, active learning, and is believed to help internalize learning goals for students.

In the third section of Figure 4-2, tallies for three statements tapping student interest in the Homework activity are given, 18, 28, and 34. These tallies indicate that about one-half the class lacks interest in doing the mathematical word problems they have for homework. An intervention strategy here can be to have students write word problems for each other or for themselves, using everyday activities such as cooking, sports, the weather, and collecting information about issues of importance to them. Another strategy is to pair or group students to work on writing word problems and take turns solving them. Other strategies may involve having guest speakers in different occupations describe how mathematics is used and why it is interesting to them.

This section has examined tallies for categories in each of the activity sections. Another way to examine these tallies is to examine them across the activity settings. Figure 4-3 shows tallies for the category of Value, across the three activity settings.

For the three statements in the During Class activity setting, between 9 to 14 of the students indicate a lack of belief in the value of mathematical word problems. For example, they reported that it is SORT OF TRUE, NOT VERY TRUE, or NOT AT ALL TRUE that, "It is important to learn to do the types of word problems my teacher explains in class." Somewhat fewer students indicate the lack of belief in the value of mathematical word problems in Working With Other Students, (9-11 students). For the Homework setting, the comparable number of students is 9-12. While there are minor differences here, the Value statements are fairly consistent across settings. Regardless of the activity there is a group of almost one half of the students who do not indicate a strong agreement with the value statements. Separate intervention strategies would probably need to be developed for each of the classroom activity settings.

Sample Report Forms

Sample report forms are given here as examples of additional ways in which the information from the Mathematics Assessment Questionnaire can be organized. These samples focus on the Affective, Motivation and Attribution categories. In one instance, the criterion-referenced or need approach is used to identify groups of students for follow up. In the other instance, the need approach is used to indicate percents or proportion (of the total class) who may need follow-up activities.

Figure 4-4 presents a class roster which lists the first names of individual students responding to at least two statements that suggest a need for follow-up instructional strategies. In this class roster all of the students who meet the indicator criterion for follow-up are listed for

Figure 4-3

Tally of an Eighth-Grade Class for VALUE Items in Each Activity Setting-During Class, Working With Others, and Homework (N=25)

Value: Setting	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE	NO RESPONSE
VALUE: DURING CLASS						
26. Even when I listen to my teacher, I cannot understand how learning to solve word problems will help me in my everyday life.	𝍸	𝍷𝍷𝍷𝍷	𝍸𝍷	𝍷𝍷𝍷	𝍸𝍷𝍷	0
28. It is important to learn to do the types of word problems my teacher explains in class.	𝍷𝍷𝍷𝍷 𝍸	𝍷𝍷𝍷 𝍸	𝍷𝍷𝍷𝍷	𝍷	𝍷𝍷	𝍷
34. Listening to my math teacher explain word problems during class helps me see how important math is.	𝍷𝍷𝍷𝍷	𝍷𝍷 𝍸	𝍷𝍷 𝍸	𝍷 𝍸	𝍷	0
VALUE: WITH OTHER STUDENTS						
32. If I work with other students on a word problem I see how useful math is.	𝍷𝍷𝍷𝍷	𝍷 𝍸	𝍷𝍷 𝍸	𝍷	𝍷	𝍸𝍷
44. Word problems seem more important when I am working hard on them with other students.	𝍷 𝍸	𝍷𝍷𝍷	𝍷𝍷𝍷𝍷	𝍸	𝍷𝍷	𝍸
46. If I worked a word problem with other students, I would see that the problem is a waste of time.	𝍷	𝍷𝍷𝍷𝍷	𝍸	𝍸	𝍷 𝍸	𝍷𝍷𝍷𝍷
VALUE: HOMEWORK						
12. I do not see any use for the word problems I get for homework.	0	𝍷𝍷𝍷	𝍷𝍷 𝍸	𝍷𝍷 𝍸	𝍷𝍷𝍷 𝍸	0
20. Being good at solving homework word problems which involve math or reasoning mathematically is very important to me.	𝍷	𝍸𝍷 𝍸𝍷	𝍷𝍷𝍷 𝍸	0	𝍷𝍷𝍷𝍷	0
39. Being able to solve the word problems I get for homework is not important to me.	𝍷	𝍷	𝍷𝍷 𝍸	𝍷 𝍸	𝍸 𝍸	0

Figure 4-4

CLASS ROSTER

Sample Eighth-Grade Class Roster for Thoughts and Feelings and Activity Settings: Names of Students Who Responded to at Least Two Statements so as to Indicate a Need for Follow-up

	ACTIVITY SETTING		
Thoughts and Feelings	During Class	Working With Other Students	Homework
Value	Eddie Betty Joyce Sharon Pricilla Lisha	Bob Arlene Janet Susan Sharon Lisha Linda	Eddie Pricilla Sharon
Interest	Joan Pricilla Sean Sharon	Arlene Bob Eddie Sharon Janet Pricilla	Arlene Alice Barbara Sharon Janet Pricilla Sean Joyce Joan Marla
Confidence	Barbara Eddie		Barbara
Anxiety	Alice Eddie Jamie Joyce Marla Arlene Ray Sharon	Betty Barbara Joan Sharon Sean Alice Roger Leon Ray Trisha Susan Joyce Dave Marla Lisha Jamie	Arlene Eddie Joyce Marla Carmelo Bob Linda Trisha Jamie Ray Dave Joan Sharon

Figure 4-4 (Continued)

CLASS ROSTER

Thoughts and Feelings	ACTIVITY SETTING During Class	 Working With Other Students	 Homework
Internal Learning Goals	Linda Trisha Pricilla	Trisha Joan Eddie Sharon	Alice Joan Bob Marla Sharon Leon Dave Eddie
External Performance Goals	Bob Leon Joyce George Pricilla Ray	Bob Arlene Eddie Carmelo	Barbara Arlene Linda Sharon Joan George Alice Roger Leon Jamie Pricilla Joyce Dave

Figure 4-4 (Continued)

CLASS ROSTER

Thoughts and Feelings	ACTIVITY SETTING		
	During Class	Working With Other Students	Homework
Internal Stable Controllable	Pricilla Linda Trisha	Barbara Alice Linda Pricilla Joyce Dave Joan Sharon Marla Lisha Janet Eddie Jamie	Marla
Internal Stable Uncontrollable	Leon Carmelo Alice Arlene Joyce Jamie Trisha Sean	Alice Betty Carmelo Jamie Leon Pricilla Sean Steven Roger	
External Stable Uncontrollable	Leon Marla Roger	Steven	George Steven Barbara
Unknown Control	Barbara Carmelo	Barbara Carmelo	Barbara Joyce

each category in each setting. Such data can be used in several ways. One use is to identify students who need to be paired or grouped with other students who may support change--to increase interest and value, to support the development of confidence. The purpose of such heterogeneous groupings would be to provide alternative models or examples of other beliefs and behaviors for students. Another use is to develop particular activities for a group of students with specific needs. For example, there are the responses of Barbara, Carmelo, and Joyce to the Unknown Control statements. Their responses indicate that they are unclear about why they succeed or fail in understanding mathematics during class, working with other students, or, for Joyce, doing homework. Activities that provide opportunities to express reasons for success or failure may help to focus these beliefs and to foster a sense of control.

Figure 4-5 shows another way of organizing the information for the whole class--the percent of students in each category/setting with need indicated. Here the overall needs of the class can be rapidly scanned, and, if desired, the high need areas can be identified for activities. Figure 4-5 also indicates the direction of the ratings of the statements. For example, for Value (lower), the lower indicates the percentage of students perceiving less or lower value to the working of mathematical word problems in an activity setting. This figure provides a numerical summary of the information in the list of names given in Figure 4-4.

Using Student Responses: During Class When Teaching about Solving Mathematical Word Problems

In the activity setting, During Class, students are asked to do the following:

> Think about when your teacher teaches about word problems.

The remaining directions are specific to each of the thoughts and feeling in the Mathematics Assessment Questionnaire -- Self-regulation, What do you do before the lesson begins, during the lesson and after the lesson. For the ten sets of thoughts and feelings, the instructions read, What do you thing and feel? Students indicate how true each statement is for them, on the scale from 1, VERY TRUE, to 5, NOT AT ALL TRUE. The statements and strategies for using them focus on the time During Class, during direct instruction of the class.

Figure 4-5

CLASSROOM SUMMARY

Sample Eighth-Grade Classroom Summary (N=25)
Percentage of Students in Each Category Whose Responses
Indicate a Need for Follow-up Activity

	Activity Setting		
Thoughts and Feelings	During Class	Working With Others	Homework
Value (lower)	24%	28%	12%
Interest (lower)	16%	24%	40%
Confidence (lower)	8%	0%	4%
Anxiety (greater)	32%	64%	52%
Internal Learning Goals (Less internal)	12%	16%	32%
External Performance Goals (more external)	24%	16%	52%
Internal Stable Controllable (more internal)	12%	52%	4%
Internal Stable Uncontrollable (more internal)	32%	36%	0%
External Stable Uncontrollable (more external)	12%	4%	12%
Unknown Control (more unknown)	8%	8%	8%

Direct instruction of the class typically serves at least some of the following functions: capturing interest, providing information, modelling the processes of solving mathematical problems for students, encouraging students to make patterns and generalizations in inquiry settings, and encouraging students to try out their understanding of new heuristics and conceptual knowledge on selected problems. These functions of direct instruction involve active student participation, whether working problems at the board, responding and initiating questions, conjecturing, trying out mathematical approaches individually or in pairs of students, and monitoring and evaluating their own progress.

In the DURING CLASS or whole class instruction setting teachers may follow a strategy of always discussing, exploring, and conjecturing with students, rather than giving answers or problem solutions directly to students. Thus, the focus should be on discussion that leads to student understanding, and problem exploration that supports this inquiry strategy. Teachers may also use problems that have more than one solution, as in the problem in the Metacognitive section of the MAQ.

Other strategies include using textbook problems and asking students to create their own problems. The emphasis should be on taking the problem apart, building new ones, and extending analyses beyond the surface of the problem, and not just looking for "the answer." In this spirit, teachers can engage students in activities such as the following:

Add more information to a problem than you need to solve it.
Delete some information that is important from a problem, causing the problem to have insufficient data.
Give the problem to a partner and let the partner identify what is missing.

These techniques can be used with traditional textbook content, changing the use to fit a different goal.

Self-Regulatory Statements

The SELF-REGULATORY statements in the MAQ focus on students' awareness of the structures and goals of instruction. Students' thoughts and feelings that influence active participation and learning in the whole class instruction are also examined. Students' experiences during classroom instruction vary. The Self-regulatory statements in the During Class setting will be interpreted by students in the context of their own experiences in mathematics classrooms.

Figure 4-6 provides the responses of a class of twenty-five eighth-grade students to the 19 statements in the Self-regulatory category. In this example the student responses to statements AT THE BEGINNING OF A LESSON indicate that most students think they are attentive and ready. Yet, some students indicate they are not as prepared--they do not have all the materials they need. Similarly, some students are not as sure about their awareness of when the teacher is reviewing, beginning new ideas or practicing new problems. For these students, it may be helpful to provide direct cues or statements as to the structure and procedures of the class. Structure introductory activities, make them explicit and make your expectations explicit. Whether a developmental lesson or exploratory activity, you will have a problem, a situation, or a statement to capture interest initially.

Another strategy is for teachers to remind students to attend to these activities:

> "Get ready to listen carefully."
> "Make sure you have all the materials you need." and
> "Make sure you are paying attention."

During the lesson students may also be told:

> "I am now going to review materials I already taught."
> "I am now beginning a new math idea."
> "This is practice in new math problems." or
> "This is practice in math we learned earlier."

Students' responses to the statements DURING A MATH LESSON ABOUT WORD PROBLEMS indicate an awareness of thinking about the answers to questions the teacher asks and understanding of examples. Students can be encouraged to reflect on a lesson by writing down what the students think is important in the lesson. The responses in Figure 4-6 indicate little awareness of thinking about what is important to learn, what the teacher is going to do next in the lesson, and the cues that signal when the teacher is about to end the lesson. Again, these responses indicate it may be helpful to some students to encourage them to think about and reflect on the process and the structure of the mathematics class in relation to their own learning.

For statements 11, 12, and 13, students are reflecting on their active participation in the class. Responses here identify the students who are not likely to say if the teacher makes a mistake, to ask for an explanation of something they didn't understand, or to volunteer to show the class if they think of another way to do a problem. There are several strategies to help students become more actively engaged in the class. For some students, this may be seen as risky behavior and they can be helped by creating

Figure 4-6

Number and Percentage (in Parentheses) of Students in an Eighth-Grade Class (N=25) Responding to Self-Regulatory Statements About Working Mathematical Word Problems DURING TEACHER INSTRUCTION

Thoughts and Feelings	Student Response VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
AT THE BEGINNING OF A LESSON					
1. I get ready to listen carefully.	6 (24)	10 (40)	8 (32)	0 (0)	1 (4)
2. I make sure I have all the materials I need.	2 (8)	7 (28)	9 (36)	6 (24)	1 (4)
3. I make sure I am paying attention.	9 (36)	9 (36)	5 (20)	1 (4)	1 (4)
4. I know when the teacher is reviewing materials already taught.	9 (36)	12 (48)	2 (8)	2 (8)	0 (0)
5. I know when the teacher is beginning a new math idea.	12 (48)	7 (28)	6 (24)	0 (0)	0 (0)
6. I know when the teacher is giving me practice in new math problems.	6 (25)	8 (33)	9 (38)	1 (4)	0 (0)
DURING A MATH LESSON ABOUT WORD PROBLEMS					
7. I think about what is important to learn in the lesson.	5 (21)	4 (17)	5 (21)	6 (24)	4 (17)
8. I know what the teacher is going to do next in the lesson.	0 (0)	0 (0)	7 (29)	6 (25)	11 (46)
9. I think of an answer to a question the teacher is asking.	5 (22)	13 (56)	5 (22)	0 (0)	0 (0)
10. I think about whether I understand an example the teacher puts on the board.	9 (36)	13 (52)	3 (12)	0 (0)	0 (0)
11. When my teacher makes a mistake, I say something about the error.	4 (16)	8 (32)	9 (36)	1 (4)	3 (12)

Figure 4-6 (continued)

Thoughts and Feelings	Student Response				
	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
12. I ask my teacher to explain a problem again that I do not understand.	8 (32)	5 (20)	9 (36)	3 (12)	0 (0)
13. When I can think of another way to solve a word problem, I volunteer to show the class.	2 (8)	3 (13)	3 (13)	7 (29)	9 (37)
14. I know when the teacher is about to end the lesson or topic.	1 (4)	4 (16)	8 (32)	7 (28)	5 (20)
AT THE END OF A MATH LESSON					
15. I ask myself if I understand the lesson.	6 (24)	10 (40)	5 (20)	2 (8)	2 (8)
16. I try to figure out if I need to do more to learn the lesson.	7 (28)	7 (28)	11 (44)	0 (0)	0 (0)
17. I decide if I need to ask the teacher a question about the lesson.	8 (32)	8 (32)	7 (28)	2 (8)	0 (0)
18. I review the word problems my teacher did.	5 (20)	5 (20)	8 (32)	7 (28)	0 (0)
19. When I review word problems from class, I evaluate if I understood the lesson.	6 (24)	7 (28)	11 (44)	1 (4)	0 (0)

Note. Numbers may not total 25 due to missing data.

a classroom environment that is nonjudgemental and places a high value on student creativity and involvement--all suggestions should be welcomed as the best tool for helping students understand correct solutions. The goal is a classroom environment where students feel free to discuss their ideas about mathematics with the teacher and class.

Student responses to AT THE END OF THE MATH LESSON indicate that again some students do not perceive themselves a) as actively evaluating their own understanding of the class lesson, b) reviewing the main ideas of the lesson in their mind and c) asking the teacher to explain what they do not understand. A strategy here is to ask these students to write what they have learned from the lesson. One form of doing this is journal writing (Borasi, R., & Rose, B.J. 1989, Journal writing and mathematics instruction. Educational Studies in Mathematics, 20, 347-365.)

Suggestions for journal writing can range from very specific ideas to general writing. Students could be asked to respond to a particular problem or topic. For example, "explain how to go about solving a problem." They could discuss particular aspects of the problem and problem solution:

Describe the problem setting.
Explore the problem by experimenting with different values.
Generate several "what-if" questions.
Make conjectures and hypotheses.
Summarize what has been learned as a result of these activities.
Create a new problem for the class to solve.

More general writing could involve making generalizations from class activities and discussing the origins of the mathematical rules under discussion.

Affective Beliefs

Instructional strategies for the affective beliefs, Confidence, Anxiety, Interest, and Value, emphasize creating a positive, discussion and inquiry-oriented classroom environment for solving mathematical word problems. Several of these strategies are illustrated here, drawing on student responses to the MAQ statements.

Figure 4-7 shows responses of the 25 eighth-graders to the 12 statements of affective beliefs DURING TEACHER INSTRUCTION. While there are some students who acknowledge a lack of Confidence, there are more students who suggest they feel afraid or scared when asked a question by the teacher or asked to work a problem before the class. Furthermore, about half of the students do not feel at ease

Figure 4-7

Number and Percentage (in Parentheses) of Students in an Eighth-Grade Class (N=25) Responding to Statements About Their Anxiety, Confidence, Value, and Interest in Working Mathematical Word Problems DURING TEACHER INSTRUCTION

Thoughts and Feelings	Student Response				
	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
VALUE					
26. Even when I listen to my teacher, I cannot understand how learning to solve word problems will help me in my everyday life.	5 (20)	4 (16)	6 (24)	3 (12)	7 (28)
28. It is important to learn to do the types of word problems my teacher explains in class.	9 (38)	8 (33)	4 (17)	1 (4)	2 (8)
34. Listening to my math teacher explain word problems during class helps me see how important math is.	4 (16)	7 (28)	7 (28)	6 (24)	1 (4)
INTEREST					
24. I enjoy trying to answer the word problems my teacher asks in class.	7 (28)	6 (24)	5 (20)	6 (24)	1 (4)
44. I get bored when other students are working word problems on the board in math class.	0 (0)	2 (8)	7 (29)	6 (25)	9 (38)
49. I like to do new word problems by myself, even before the teacher explains them.	3 (12)	9 (36)	4 (16)	5 (20)	4 (16)

Figure 4-7 (continued)

Thoughts and Feelings	Student Response				
	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
CONFIDENCE					
20. I feel confident that I will be able to follow any word problem my teacher explains in class.	2 (8)	10 (40)	9 (36)	3 (12)	1 (4)
31. I do not expect to be able to answer the questions my math teacher asks about word problems.	0 (0)	3 (12)	8 (32)	9 (36)	5 (20)
48. If my math teacher asks me to solve a word problem on the board, I am sure I will get the wrong answer.	2 (8)	1 (4)	3 (12)	9 (36)	10 (40)
ANXIETY					
27. I am afraid when I have to ask my teacher a question about a word problem during class.	5 (20)	4 (16)	6 (24)	3 (12)	7 (28)
35. When I am in math class, I usually feel very much at ease and relaxed.	5 (20)	4 (16)	5 (20)	6 (24)	5 (20)
39. I get scared when I have to work a problem on the board.	8 (33)	4 (17)	5 (21)	4 (17)	3 (12)

Figure 4-7 (continued)

Thoughts and Feelings	Student Response VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
INTERNAL LEARNING GOALS					
30. I volunteer to do word problems on the board so I can learn something more about math.	0 (0)	5 (20)	8 (32)	5 (20)	7 (28)
32. I pay attention during my teacher's lessons on word problems because it helps me learn math.	5 (20)	11 (44)	7 (28)	1 (4)	1 (4)
42. I volunteer to answer questions about word problem in math class because it helps me understand the math.	4 (16)	4 (16)	9 (36)	6 (24)	2 (8)
EXTERNAL PERFORMANCE GOALS					
25. I only answer questions about word problems in math class to please my teacher.	0 (0)	1 (4)	5 (20)	8 (32)	11 (44)
36. I pay attention when my teacher explains word problems if I know I will have a test on them.	15 (60)	3 (12)	1 (4)	4 (16)	2 (8)
40. I volunteer to do a word problem on the board if I think it will help my grade.	4 (16)	4 (16)	6 (24)	6 (24)	5 (20)

Figure 4-7 (continued)

Thoughts and Feelings	Student Response VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
INTERNAL STABLE CONTROLLABLE					
43. If I understand a word problem my teacher is explaining, it is because I am trying as hard as I can.	6 (24)	5 (20)	10 (40)	4 (16)	0 (0)
45. The next time my math teacher explains a word problem to the class, I expect to understand because I listen carefully.	5 (20)	13 (52)	5 (20)	2 (8)	0 (0)
47. Because I pay attention, I know I will be able to understand the word problems my teacher explains in class.	5 (21)	7 (29)	7 (29)	5 (21)	1 (4)
INTERNAL STABLE UNCONTROLLABLE					
22. If I correctly answer a question my teacher asks about word problems, it is because I have the ability to learn math.	10 (42)	7 (29)	3 (13)	3 (13)	1 (4)
37. If I can follow my teacher's explanation for word problems, it is because I am smart.	2 (8)	4 (18)	8 (33)	8 (33)	2 (8)
41. If I can solve a word problem the teacher puts on the board, it is because I think mathematically.	2 (8)	4 (16)	9 (36)	5 (20)	5 (20)

Figure 4-7 (continued)

Thoughts and Feelings	Student Response VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
EXTERNAL STABLE UNCONTROLLABLE					
23. If I understand the word problems my teacher does on the board it is because I have a good teacher.	5 (20)	7 (28)	6 (24)	3 (12)	4 (16)
29. If I am able to solve a word problem on the board, it is because the problem was easy.	0 (0)	3 (12)	5 (20)	8 (32)	9 (36)
46. If I correctly answer a question the teacher asks about a word problem, it is because the teacher picks good problems.	2 (8)	1 (4)	5 (20)	9 (36)	8 (32)
UNKNOWN CONTROL					
21. When I correctly answer a question my teacher asks about word problems, I usually do not know why I get it right.	0 (0)	6 (24)	7 (28)	4 (16)	8 (32)
33. I usually do not know what is going on when my teacher is explaining a word problem.	1 (4)	2 (8)	3 (12)	8 (32)	11 (44)
38. I do not know why I cannot follow the word problems my teacher works on the board.	0 (0)	3 (13)	3 (13)	8 (32)	10 (42)

Note. Numbers may not total 25 due to missing data.

and relaxed in this mathematics class. These responses are consistent with the self-regulation section, where there is a group of students who report they are not actively engaged in the class.

One activity for creating a positive classroom environment that reduces anxiety is to examine myths about mathematics (Frank, M.L. What MYTHS about mathematics are held and conveyed by teachers. Arithmetic Teacher, 37, No.5, Jan. 1990, 10-12.) A mathematics myth is a belief that results in false impressions about how mathematics is done. Such myths can lead to math anxiety as well as math avoidance. Frank (1990) lists 12 math myths:

Some people have a math mind and some don't.
Math requires logic, not intuition.
You must always know how you got the answer.
Math requires a good memory.
There is a best way to do a math problem.
Math is done by working intensely until the problem is solved.
Men are better in math than women.
It is always important to get the answer exactly right.
Mathematicians do problems quickly, in their heads.
There is a magic key to doing math.
Math is not creative.
It's bad to count on your fingers.

One strategy is to engage students in a class discussion that is centered around their opinions of these statements. To encourage discussion, students can be asked questions such as:

Are these myths really false (Frank, p. 12)?
What do "real" mathematicians do when they solve mathematics problems?
What do people do when they solve mathematics problems encountered in real life?
Are men really better in mathematics than women?
Did you have any experiences that led you to believe the math myths?
Did you have any experiences that made you anxious about mathematical problem solving?
How do you think your mathematical beliefs interfere with your learning of mathematics?

A technique to change the belief that a memorized rule can be applied to solve a non routine problem (a form of the mathematics requires a good memory myth, Frank, p. 12) is to focus students' attention on trying to understand the problem and problem solving strategies. Emphasizing problem-solving, estimation and conceptual understanding would help to change such a math myth, since the student does not focus on memorizing rules, but rather on understanding and interpreting (Frank, p. 12).

For Value and Interest, there are again groups of students who do not see the relation between word problems and everyday life and who do not enjoy trying to solve problems the teacher asks in class. While there may be various reasons for these attitudes there are several strategies and activities that can be used during class to relate mathematics word problems to students' interests and everyday life situations. As one example, Saunders (1980) (Saunders, H. When are we ever gonna have to use this? Mathematics Teacher, 73, no.1, pp. 7-14), interviewed representatives from 100 different occupations to make a checklist of the mathematical topics each representative used.

Students can design and carry out a similar study, making lists of mathematical topics and problems, developing examples of each, and asking persons in occupations about their use of mathematical topics. These results can be summarized and the class can develop a display or report on what they found. Teachers can help students to discover that the more mathematics they learn, the more opportunities they will have in choosing occupations. Students will also discover that mathematical topics are used in all occupations.

Another strategy is to ask students to write a statement about their interests in both school subjects and out of school activities. These statements will identify areas of interest and can be used as a basis for writing mathematical word problems for the class, both by the teacher and by the students.

Motivations

Two sets of statements are concerned with motivations: the internal learning goals and external performance goals. In Figure 4-7, several students indicated that they perceive little relationship between volunteering to do word problems in class and learning mathematics for its own sake. Rather, their active engagement in classroom activities is strongest when they know they will have a test or if they think it will help their grade. The active participation for some students is linked to external incentives, not the satisfaction derived from learning.

Strategies for the class can include focusing on the value of learning to solve mathematical problems, and on a broader form of assessing student understanding. For example, if students volunteer answers or work on problems before the class, the emphasis can be on the use of a variety of ways to solve a problem rather than simply "getting the right answer" (the problems posed must support alternative ways of solution). Students can be encouraged to help each other during this activity. This further reinforces the view that it is acceptable to try out different approaches to problems.

Another strategy would be to encourage students to write and collect problems that they solved in different ways, and to develop a portfolio for mathematics. The portfolio could include projects that relate to their interests, as on computers or history of mathematics. Students can write what they learned about mathematics from their projects or developing and solving problems. The evaluation here would not emphasize a grade, but comments on what the student had learned and expectations for new learnings and a higher standard, if appropriate.

Attributions

Beliefs about causes of success and failure in working mathematical word problems during class are assessed in four sets of statements. In the During Class setting, the attributions are concerned with student success and whether it is attributed to:

> an internal stable cause under the student's control ("If I understand a word problem my teacher is explaining, it is because I am trying as hard as I can"); or
>
> an internal stable cause that the student CANNOT control, and hence has no responsibility for ("If I can follow my teacher's explanation for word problems, it is because I am smart"); or
>
> an external stable cause that the student cannot control ("If I am able to solve a word problem on the board, it is because the problem was easy"); or
>
> an unknown cause ("I usually do not know what is going on when my teacher is explaining a word problem").

For the class responses in Figure 4-7, most students have a sense that their efforts are effective in assisting them to learn about working mathematical word problems. However, a small group of students attributes their successes to such causes as the problem was easy or the teacher picks good problems. The beliefs of these students may result in less persistence in working on problems that they do not solve immediately. In a class setting, one strategy that may be helpful is to increase the "wait time" for them; if they do not respond immediately to a question, wait and give them time to work on the problem. Students can be told that there is "thinking time" needed for mathematics problems.

For the small number of students with no sense of what is going on, teacher follow-up is needed. Individual work may be needed to assist students to make a connection between what they do and the outcome of successfully solving a problem. In this instance, problems will need to be tailored for the individual student, so that, with effort, a problem can be solved. Gradually, the student is provided with a series of successful experiences. Another strategy is for students to work in pairs. Students explain their thinking to one another. They are encouraged to talk about how long they worked and the procedures they used. In this way students begin to link persistence and effort with accomplishment.

Using Student Responses: Working with Other Students in a Group Solving Mathematical Word Problems

In this activity setting, students are asked to do the following:

> Think about solving a word problem with a group of other students. If you have never solved a word problem with other students, imagine what it would be like.

Students indicate how true each statement is for them, on the scale from 1, VERY TRUE, to 5, NOT AT ALL TRUE. The strategies focus on students' mathematical problem-solving in groups.

Group mathematical problem-solving is a technique that can be used to facilitate a number of educational goals. It can be used flexibly, depending on these classroom goals and the block of time available for mathematics. With 40-50 minute classes, group work may carry over from one class to the next, and be used perhaps 1-3 times per week. With a two-hour time block, it might be used more frequently. The use of group problem-solving in mathematics classrooms poses new learning opportunities for both students and teachers, and requires different roles and responsibilities for both students and teachers. Some aspects of these learning opportunities are described here. Others are found in works by Johnson and Johnson (1987) and Slavin (1983).

Self-Regulatory Statements

The self-regulatory statements are concerned with students' taking control and responsibility for their thinking about and participating in the group work. The statements can help to focus student attention on their roles and behaviors in this type of classroom activity.

Some of the statements focus on the students' monitoring of their own behavior, and other statements focus on their behaviors or interactions with others in the group.

Examples of the students' monitoring of their own behaviors are statements: "I make sure I have all the materials I will need." --their responsibility to bring whatever is needed to the group's activities; and "I try to work the problem by myself first." The second statement is especially important for mathematical problem-solving. Students need an opportunity to work the problems by themselves for a few minutes before going to a group. They need to give the problem some thought and write something down, so they do not come to the group empty-handed. If they have difficulty they can write things such as:

> Why can't I do this problem?
> What is confusing?
> This is the confusing part of this problem.
> I cannot get started because of this word.

To identify their confusion is a form of self-regulation. This behavior can be fostered by structuring individual work time before the group is together.

The statements at the end of the section, (statements 22 and 23), also reinforce the individual monitoring of understanding: "I know if I learned ways to do the word problem;" and, "I know if I will be able to solve word problems like this." Students can be encouraged to ask themselves these questions, as well as make the other self-monitoring statements, (statements 1-3, 13-14, and 17-18 in Appendix 4-1, pages 9-10).

Examples of the group interaction statements are in statements 12 and 13: "I encourage the other students to work on the problem too;" and "I listen carefully to what everyone says about the problem." One way to encourage interaction in groups is to identify roles for students to play while the group is working. These roles can draw on the statements in the self-regulatory area and on those in the metacognitive area. For example, students could take on specific roles. Questions for their roles could be written on cards:

Monitor. A monitor is the person who keeps the work on track. The monitor might ask:

> Q. Have we taken care of all the parts of the problem?

Problem Solving Expert. A problem-solving expert is the person who asks key questions. The problem-solver might ask questions like the following:

Q. Can somebody in the group say what the question is asking? Or, can each person, in turn, say what the question is asking?

Q. Can somebody say how this problem looks at all like any other problems we've worked?

Q. Can somebody tell us what information we need to work this problem?

Checker. A student taking the role of checker might use statements 17-21 (in Appendix 4-1, page 10) as guides. The checker would have the responsibility for seeing that the right procedures were used, checking that the calculations were right, asking the students if anyone thinks the answer is wrong, and asking the others to discuss whether they think the answer makes sense.

These roles provide an example of using the statements as instructional materials. The roles should be rotated to provide practice for all the students, and to raise their awareness about the thinking processes and the cognitive activities that occur in group problem-solving as well as in individual problem-solving.

Other types of roles, such as those studied in the cooperative group literature, overlap and expand the roles suggested by the self-regulatory statements. For example, Johnson and Johnson (1987, p. 51) have roles such as recorder, encourager, observer, summarizer-checker, and researcher-runner. The recorder is the person who writes down the group's decision and, for writing projects, edits the group's report. The encourager is asked to reinforce or support group members' contributions, the observer keeps track of how well the group is collaborating, the summarizer-checker makes sure everyone in the group understands what is being learned, and the researcher-runner gets needed materials for the group and communicates with other learning groups and the teacher.

The Johnson and Johnson (1987) roles emphasize the group's learning task and the group's need to attend to the interpersonal processes that keep the group smoothly functioning and each person participating. The role of summarizer-checker or checker is of particular importance in mathematics problem-solving. The role suggests that there must be a stipulation that each person in the group must be able to get up and explain the group's results. This is a critical component of group problem-solving to ensure learning for each student. Students will "peer tutor" each other if the setting is structured for this purpose, and can often explain concepts and procedures to each other in various ways, until successful.

Another way of ensuring each individuals' participation in the group is by using a reward system where groups in some manner "get credit" for their results. If someone in the group cannot explain the results satisfactorily, the group does not get credit for its results. The self-regulatory statement 19, "I ask the other students whether anyone thinks the answer is wrong," is one type of question the checker can use. The checker can also request that each of the students explain the procedures and results to the other group members.

A technique to use in helping to ensure that students encourage each other to understand the problem and results is the following. Randomly select the student who will report the group's results to the class. Each person in the group can be assigned a number from 1-4. The teacher can have pieces of paper numbered 1-4 or a die to see whose number comes up. The person with the chosen number goes to the board and explains the group's results. Using this procedure helps student's perceive the selection as fair. The process is not punitive; if one student doesn't understand a problem procedure and solution, then all the students have not played their part--each one is responsible for the learning of all. Johnson and Johnson (1987) provide further discussions of the teacher's role in cooperative learning and assisting students to acquire cooperative skills (see especially chapter 6, Student Acquisition of Collaborative Skills). Slavin (1983) also provides insightful discussions of cooperative learning.

Affective Beliefs

Instructional strategies for the affective beliefs, Confidence, Anxiety, Interest, and Value, can use several ways of assigning students to groups, structuring group tasks, and using group roles to facilitate reducing anxiety and building confidence. For example, a student may respond to the confidence statements indicating a lack of confidence in working with a group. The three confidence statements are:

> If I worked with other students, I am sure I could solve most math word problems.
>
> I have no confidence in my ability to solve a word problem with other students.
>
> If I worked on a word problem with other students, I know I would be able to help to solve the problem.

One strategy for students who indicate a lack of confidence is to ensure heterogeneity in the group. This puts the student in a position both to give help and to receive help. The students might be assigned the task of deciding what different skills exist in the group for solving a problem:

What am I really good at?
What are you really good at?

On this basis they can decide how to divide up the work. It becomes clear that integral to the group is giving and receiving help. Some students may say, "I'm best at looking it over after it's done." Others may say, "I like to check it."

The positive attitude about the group can also be affected by careful selection of the problem. It is important to build confidence and decrease anxiety with initial success. First give problems that are do-able, and then increase the level of difficulty. The students should be together for a sufficient period of time to develop into a working group, to bond. If a goal is to have students in the class get to know one another, and to work with different people, then you may want to rotate group membership over the course of the semester.

Initially, in arranging groups, students can help with the decisions. After the class has met for several weeks, routines will be established and you will know students. Students can then be given an opportunity to write down the names of 1 or 2 students they would like to be with in a group. You can tell students that with this information about how they get along, you can try to accommodate at least one friendship choice when you arrange the groups. This should also help to relieve anxiety.

Another strategy to increase confidence is assignment of the roles discussed earlier--the summarizer-checker, the monitor, the problem-solving expert, and the reader or the encourager--to give students guided practice in asking the questions for each role so that these skills are mastered.

To increase students' Interest and Value, structuring the groups' task in the following way may be useful. If students are asked to do different pieces of the work and each person's piece is required to have the whole work come together, students are likely to find what other students say interesting and valuable. It is like fitting together the pieces of a jigsaw puzzle. Either a problem-solving task or a supplemental assignment could be used. For example, in a lesson to investigate the sum of the angles of triangles, each student in the group can have a differently-shaped triangle and a protractor. Each measures the angles of their specific triangle, and writes down a sentence about what they have discovered. The group tries to come up with a generalization. Similar work can be done with other concepts--parallelograms, surveys in probability and statistics, and so on.

For a supplemental assignment, an historical investigation of a topic in mathematics could be developed--the history of the calculus or the counting numbers. One person can develop a dateline, others biographies of mathematicians responsible for the topics' development, and another how it influences our lives today. The group can create a presentation, a bulletin board, or a report.

Another strategy for increasing awareness of interest is making up problems for other groups or group members to solve, drawing on their own out-of-school activities and special interests. Additionally, a mathematics log can be kept, where each student writes what they have learned at the end of mathematics class. Students may find it difficult to write about math, and the skill may need to be developed gradually. Initially students can be asked to write answers to very specific questions such as:

> Write down something that you know today that you didn't understand yesterday, or,
>
> Write down something that you are confused about.

The suggestions may help students get started. Students can also read the logs to each other when they met in groups.

To increase students' feelings about the value of mathematics several strategies may be helpful. Some students who are very skilled in mathematics may not see any value in working on mathematical problems in a group. Several points can be made with these students--their own mathematical understandings may move to a higher level when they do helping or tutoring and, for many future occupations they will need to interact with and explain their views to others. It may assist students to understand these points if they discuss the question, "What do you feel you have gained from explaining this problem in your group?" The group can be seen as an example of life in groups outside the classroom.

The value of mathematics may also be better appreciated if students write word problems that have relevance in their lives. They can also role play problems before beginning to solve them, "You're working in a bank and you come in and say to me...." Students can also write word problems and exchange them between groups, again writing problems from situations in their lives.

Motivations

Motivations underlie students' beliefs about working in groups and the benefits of group work to them. Students may believe that the only reason for working in a group is because the teacher tells them to, or because they will get a better grade if they do what the teacher wants. To encourage internal learning goals students need to recognize that working in groups solving mathematical problems can help them in learning to solve mathematical problems. To assist students to develop such internal learning goals group placement can be important. Students will need to be in a group where they can get help, and/or they can recognize that by helping someone they have increased their own understanding and have learned more mathematics themselves.

Another strategy is to assist students in making connections between learning now and their future goals. The reasons or motivations for developing problem-solving skills need to be seen as connected to the student's goals, so less reliance is placed on external classroom reward systems.

Attributions

Beliefs about causes of success and failure can also be influenced by the group setting. Several strategies can be tried to help students who cannot attribute the groups' success or failure to the group activities and processes. These students may need to recognize the important links between knowing the mathematical concepts and procedures, carrying them out, and successfully solving a word problem. One strategy to help such students is for them to take on the role of checker. This person goes back and reviews work to make sure it was done correctly. Similarly, if a student has to report to the class, each student in the group is responsible and has an investment in the reporter's understanding. The reporter can explain the problem to each student in the group--and the group will be able to focus on the reporter's understanding of the problem.

Another belief that some students may have is that the group succeeds only because of ability (or fails because of some factor external to the group). In group problem-solving the winning or successful groups may not necessarily be those with students with the highest averages. Rather, they tend to be groups with the best working relationships. Understanding and attributing group success to working relationships rather than strictly ability, can help students develop the belief that their efforts and activities can lead to success in mathematical problem solving.

One strategy to assist them in attributing success to the efforts of the group is to focus on the group process itself. For example, each group can be asked to name two things they did well, and one they would want to work harder on. They can be asked to examine the relationships--what did we do well, how did we behave, and how successful or hard was it to solve the problem? Students may say, "We stuck with it, we didn't give up, we listened to each other even though we thought it was a bad idea." Here students are encouraged to focus on what they did, rather than ability.

Other strategies which can be used to help students examine how effectively the groups are working follow suggestions by Johnson and Johnson (1987). One suggestion is to have each group member exchange with one another an action they did that reflected an effective use of a cooperative skill. Another suggestion is the use of a "processing sheet." Students write on this sheet, "This person asks for help, this person shares ideas, this person gives help, ..." Johnson and Johnson emphasize that this process should focus group members on positive rather than negative behaviors: "A positive focus may result in feelings of satisfaction and efficacy" (Johnson & Johnson, 1987, p. 147). These feelings of efficacy emphasize the expectation of success through personal effort, a key belief in persisting in tasks such as problem-solving and in achieving in mathematics.

To summarize there are two key points in assisting groups to focus on processing:

1. groups need time to reflect on how they are working with each other; and

2. groups need a set of questions and procedures to help them do this.

Further examples of questions and procedures are given in Johnson & Johnson (1987, pp. 143-161).

Using Student Responses: When Working Mathematical Word Problems for Homework

In the activity setting, Homework, students are asked to do the following:

Think about when you work word problems for homework.

Then students are asked to think about their thoughts specifically related to the self-regulation section of the MAQ and those related to the affective, motivational, and attributional beliefs. Students are asked to indicate how true each statement is for them, on the scale from 1, VERY TRUE, to 5, NOT AT ALL TRUE.

Homework is an activity that can be used to facilitate a number of educational goals. It can be used to provide time for independent work and practice on a series of word problems, ranging from very easy to challenging. It can also be used to encourage students to work in pairs or groups on non routine or nonstandard problems. And, homework can also be used to encourage student writing about mathematics and private dialogue with you on learning progress and feelings of accomplishment. It can also meet a need for some students to ask individual questions outside of the classroom setting.

Since there are different goals for homework, strategies for using students' responses to the homework statements will vary. Strategies will also vary depending on the type of homework word problems given, class sizes, in-class use of student work, and the frequency of assigning homework. The use of other techniques, such as learning logs and groups and pairs of students collaborating, in conjunction with homework assignments, also provides opportunities to expand the role of homework activities in mathematics classrooms.

These strategies do not deal with the very real problems of handling or checking homework from 3-5 classes of 25-40 students, where homework is assigned on a regular basis. Various efforts have been made to handle the logistics of the volume of student work created in large school settings. These include random checking of student work, carbons of student work, putting problems on the board before class, using overhead projectors, self or peer checking (that may too often focus on the answers only), working in pairs or groups, and so on. The focus here is on the use of information from the MAQ in class time, as an opportunity to work with students on the thoughts and feelings around doing homework word problems to learn mathematics.

One other point is key here: with an emphasis on the thoughts and feelings of students while learning mathematical word problems, the quality of the homework assignment becomes critical. To focus on the process of mathematical problem-solving, homework needs to include challenging problems within the range of students' mathematical development. As a teacher said, "If you can turn your brain off and turn the calculator on and do the homework that way, it wasn't terrific. If the brain had to stay on and the calculator was incidental, it was probably good homework!"

Self-regulatory Statements

The statements here are focused on student awareness of their control over, and responsibilities in, doing homework with mathematical word problems. The statements are grouped in three sections: Before you begin to work the homework word problems; While working the homework word problems, and After working the homework word problems.

Examples of students' control in the activity are statements 1 and 2: "I decide when is the best time to do my math homework word problems;" and, "I decide home much time to spend on my math homework word problems." In Figure 4-8 the numbers and percents agreeing that the statement is VERY TRUE to NOT AT ALL TRUE are given for an eighth-grade class.

In this class of 25 students over a third of the students indicate that these statements are NOT VERY TRUE or NOT AT ALL TRUE. One strategy to help students develop control before beginning their homework would be to have a class discussion about managing time and what constitutes effort on homework. Particularly with an independent setting such as the homework activity, some students may stop when they encounter something they can't do. Class discussion can focus on the point that the answer to the mathematics question is secondary. Their effort should be on actually recording the attempts they have made toward solution. How far did they get? With the focus on problem-solving as a process, students can record what they are thinking, however far they get.

Key ideas in thinking about time and managing time can also focus on what students actually do on each problem, not on the amount of time --half an hour or an hour, which the problem takes to work. Students will work at different paces. Students can be encouraged to do something on each problem, not stopping at statement 1, if it is hard for them. They write something for statement 1, then go on to statement 2, and write something there, and so on. Students can also be taught to understand what managing time means. Time is spent on each problem, and it means continually asking, now what do I do? These strategies will increase the time spent, increase the value of the time spent, and reduce a strict focus on the answer.

More specific examples of what a student can do with the time include:

Write the main ideas.
Write the information I get from the problem is ...
Write I knew how to do ...

Figure 4-8

Number and Percentage (in Parentheses) of Students in an Eighth-Grade Class (N=25) Responding to Self-Regulatory Statements About Working Mathematical Word Problems for HOMEWORK

Thoughts and Feelings	Student Response VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
BEFORE YOU BEGIN TO WORK THE HOMEWORK WORD PROBLEMS					
1.I decide when is the best time to do my math homework word problems.	5 (20)	7 (28)	4 (16)	4 (16)	5 (20)
2.I decide how much time to spend on my math homework word problems.	2 (8)	6 (24)	6 (24)	4 (16)	7 (28)
3.I make sure I have all the materials I need.	3 (12)	10 (40)	5 (20)	5 (20)	2 (8)
WHILE WORKING THE HOMEWORK WORD PROBLEMS					
4.I read each problem carefully.	11 (44)	11 (44)	2 (8)	1 (4)	0 (0)
5.I keep track of my work as I am doing a homework word problem.	10 (40)	10 (40)	5 (20)	0 (0)	0 (0)
6.I make sure I try every problem, even if I cannot solve them all.	9 (36)	14 (56)	1 (4)	1 (4)	0 (0)
AFTER WORKING THE HOMEWORK WORD PROBLEMS					
7.If I cannot do the word problems, I write out all the steps I can do and bring them to class.	1 (4)	4 (16)	12 (48)	7 (28)	1 (4)
8.If I do not understand the homework word problems, I ask the teacher to explain them.	6 (24)	6 (24)	8 (32)	5 (20)	0 (0)
9.I review my homework word problems before class.	2 (8)	3 (12)	4 (16)	11 (44)	5 (20)

Write I didn't know how to do ...
Write I got this far...
Write I couldn't go on because...
Write I don't know whether to multiply or divide.
Write I know the answer has to be small but I'm not sure how to get it to happen.

Discussion with students will encourage students to come up with other statements that they can write down as they work on problems. Students can work in pairs or groups to list other statements they can write down. All of these strategies are aimed at increasing their awareness of what they are doing. The goal is to support an increase in their sense of control in learning and a focus on the process of problem-solving. Other samples of annotating or writing about the problem-solving process by students is given in Fortunato, Hecht, Tittle, and Alvarez (1990).

Statements 5, 6 and 7 also emphasize writing out specific statements about the problem-solving process. While few students indicated that they did not keep track of work or try every problem, the responses to statement 7 indicate that they are not thinking about keeping track of their work or trying each problem in the way discussed above. Their interpretation of these statements did not have the same meaning as in statement 7, If I cannot do the word problems, I write out all the steps I can do and bring them to class. The writing will give students the opportunity to remember where they got stuck on problems.

The emphasis on writing while doing homework can be related to the learning log activity. Students can also be encouraged to write their general thoughts and feelings while working on word problems for homework, including raising questions they would like answered in class.

A small group of students indicated they would not be likely to ask their teacher to explain problems they don't understand (statement 8). Strategies to encourage students to ask questions in class include asking them questions they can answer, so they will feel successful. The questions can increase in difficulty, so they can understand that it is acceptable to ask when you don't know. The learning log provides another way for students to communicate questions.

Affective Beliefs

Instructional strategies for the affective beliefs of Confidence, Anxiety, Interest and Value emphasize providing positive experiences in mathematics. In the example presented in Figure 4-9 students' responses to the Confidence statements indicate confident attitudes. However, the responses to the anxiety statements suggest some of the students are concerned about doing hard homework

Figure 4-9

Number and Percentage (in Parentheses) of Students in an Eighth-Grade Class (N=25) Responding to Statements About Their Anxiety, Confidence, Value, and Interest in Working Mathematical Word Problems for HOMEWORK

	Student Response				
Thoughts and Feelings	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
VALUE					
12. I do not see any use for the word problems I get for homework.	0 (0)	3 (12)	7 (28)	7 (28)	8 (32)
20. Being good at solving homework word problems which involve math or reasoning mathematically is very important to me.	1 (4)	12 (48)	8 (32)	0 (0)	4 (16)
39. Being able to solve the word problems I get for homework is not important to me.	1 (4)	1 (4)	7 (28)	6 (24)	10 (40)
INTEREST					
18. I like working on math homework word problems.	0 (0)	6 (24)	7 (28)	5 (20)	7 (28)
28. The math word problems I get for homework are interesting to me.	0 (0)	2 (8)	11 (44)	7 (28)	5 (20)
34. Working on word problems for homework is very boring.	3 (12)	1 (4)	7 (28)	9 (36)	5 (20)

Figure 4-9 (continued)

Thoughts and Feelings	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
CONFIDENCE					
13. I never expect to be able to do the types of word problems I get for math homework.	0 (0)	3 (13)	4 (17)	10 (44)	6 (26)
22. I have a lot of confidence that I can do homework word problems.	7 (28)	8 (32)	9 (36)	1 (4)	0 (0)
35. I do not have any confidence when it comes to doing word problems for homework.	0 (0)	2 (8)	5 (20)	7 (28)	11 (44)
ANXIETY					
19. I feel nervous when I think about doing hard word problems for homework.	2 (8)	3 (12)	6 (24)	6 (24)	8 (32)
26. I feel relaxed when I am doing math word problems at home.	5 (20)	5 (20)	7 (28)	4 (16)	4 (16)
36. Doing word problems for homework does not make me nervous.	5 (20)	9 (36)	5 (20)	3 (12)	3 (12)

Student Response columns.

Figure 4-9 (continued)

Thoughts and Feelings	Student Response				
	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
INTERNAL LEARNING GOALS					
15. I do not like to do word problems for homework unless I can learn something new by doing them.	1 (4)	10 (42)	8 (33)	4 (17)	1 (4)
23. I like to do hard homework word problems because I learn more math by doing them.	4 (16)	4 (16)	8 (32)	5 (20)	4 (16)
31. I like to do challenging word problems for homework because solving them helps me learn math.	4 (16)	4 (16)	9 (36)	4 (16)	4 (16)
EXTERNAL PERFORMANCE GOALS					
14. The only reason I would do extra homework problems is if I could get extra credit.	4 (16)	7 (28)	6 (24)	1 (4)	7 (28)
29. I would do challenging math word problems for homework if I could get a better grade.	2 (8)	12 (50)	3 (13)	3 (13)	4 (16)
33. The only reason I do my math homework word problem is because my math teacher tells me I have to.	3 (12)	4 (16)	8 (32)	2 (8)	8 (32)

Figure 4-9 (continued)

Thoughts and Feelings	Student Response				
	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
INTERNAL STABLE CONTROLLABLE					
17. If I am able to do word problems for homework, it is because I listen in class.	4 (16)	11 (44)	8 (32)	1 (4)	1 (4)
25. If I can do the word problems I get for homework, it is because I spend enough time on them.	3 (12)	10 (40)	9 (36)	1 (4)	2 (8)
37. I know I can do word problems for homework because I work hard on them.	6 (26)	6 (26)	9 (39)	2 (9)	0 (0)
INTERNAL STABLE UNCONTROLLABLE					
10. If I am not able to do my next math homework word problems, it is because I am not clever in math.	1 (4)	2 (8)	7 (29)	6 (25)	8 (34)
16. I will not be able to do my next homework word problems because I do not have the ability to do them.	1 (4)	0 (0)	5 (21)	6 (25)	12 (50)
38. If I cannot do math homework word problems, it is because I am not smart enough.	0 (0)	1 (4)	4 (16)	9 (36)	11 (44)

Figure 4-9 (continued)

Thoughts and Feelings	Student Response				
	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
EXTERNAL STABLE UNCONTROLLABLE					
21. I will not be able to do word problems for homework unless the problems are easy.	1 (4)	1 (4)	2 (8)	7 (28)	14 (56)
27. If I am unable to do homework word problems, it is because the math book is confusing.	0 (0)	3 (12)	8 (32)	9 (36)	5 (20)
32. If I cannot do homework word problems, it is because the problems are confusing.	2 (8)	6 (24)	9 (36)	6 (24)	2 (8)
UNKNOWN CONTROL					
11. When I cannot do my math homework word problems, I usually do not know why.	1 (4)	1 (4)	7 (28)	7 (28)	9 (36)
24. If I get homework word problems right, I usually do not know why	0 (0)	2 (8)	2 (8)	10 (40)	11 (44)
30. I usually do not understand why I get word problems for homework wrong.	1 (4)	4 (17)	6 (25)	6 (25)	7 (29)

Note. Numbers may not total 25 due to missing data.

problems. The experience is not perceived as worry-free by some of the students. Students may feel it is acceptable to admit to some nervousness about doing homework and that it is not acceptable to admit to a lack of confidence about doing mathematics homework.

Looking at the Interest statements, the majority of the students indicate they do not like working on their math homework problems and many problems are not interesting to them. However, most of these students think that it is important to be good at solving these math homework problems.

One strategy for students who lack confidence, are anxious, or lack interest is to have them write their own problems. In writing a problem, students often have an idea of where they want the problem to go and can work out how to solve it. Such problems hold more interest for the student because they are written about topics which the student choses. Students also enjoy solving problems which are written by other students. This contributes to both their interest in the problems and their confidence about working the problems. The problems can be gathered together in a booklet, to reinforce what students have done.

Interest in problems is a powerful motivator to help students to persist on difficult problems. There are obvious links to the everyday use of mathematics, such as in making change, shopping, and sharing pizzas. Other sources for students and teachers to write problems of interest are in record books, such as an almanac and the Guiness Book of Records. Life skills as the basis of problems include those necessary when working for others: How do you know if your paycheck is accurate?

Motivations

Internal learning goal and external performance goal statements are also given in Figure 4-9. The responses to these statements indicate a mix of patterns. Students indicate they don't like homework word problems unless they learn something new (statement 15), yet they tend not to like the hard homework problems. These responses could provide the basis for group or class discussions about the apparent contradictions in thinking.

There is a majority of students who may be predominantly motivated by external incentives--extra credit, better grades, and teacher authority. Persistence such as that necessary in problem-solving tends to be linked to internal sources of motivation, the internal learning goals. One strategy to support internal learning goals is to focus on the process of working mathematical word problems. This process is not as clearly visible for grading, so emphasizing the importance of process puts less emphasis on right answers and less emphasis on grades and extra credit for right answers. Emphasizing attention on process should also increase successful solutions, another outcome reinforcing internal learning goals as a motivation for persisting in mathematics.

Attributions

Beliefs about causes of success and failure are in statements attributing success in doing homework word problems to effort (an internal, stable, and controllable cause of success) and failure to ability or being clever in mathematics (an internal stable and uncontrollable cause). Other statements attribute failure to easy problems or a confusing math book (external stable uncontrollable causes). One other belief about causality is that of unknown control. In this instance students agree with statements that they do not know why they succeed or fail when doing homework problems.

In Figure 4-9, there appears to be a small set of students who attribute their failure to succeed on homework problems to external causes and who are not sure why they succeed or fail. For these students a strategy is to make sure there are several problems on the homework that they can do. They need to have some success so that they can be helped to explicitly make the connection between their own effort and succeeding. It should be helpful to have them talk about success as due to their efforts.

For problems that are challenging to these students, the strategy of writing down the main idea or the information in the problem also gives them a starting point. Students can use this writing as one way to contribute to the class. Again, it is important to help students understand their beliefs by making clear the relationship between cause and effect -- what they do and the effect it can have on problem-solving, on learning mathematics, and on class participation.

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Appendix 3-1, Fall 1988 Sample Responses for grades 7, 8, and 9 for all MAQ Statements

Mathematics Assessment Questionnaire: A Survey of Thoughts and Feelings, for Students in Grades 7-9

Fall 1988

Page 1

School: TOTAL (Grades 7, 8)

Question Id	Grade Seven (N=600)								Grade Eight (N=602)							
	No		Maybe		Yes		Missing		No		Maybe		Yes		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
WORKING A MATH PROBLEM																
Before You Begin																
MET1	49	8	47	8	500	84	4	1	42	7	34	6	520	87	6	1
MET2	93	16	100	17	397	67	10	2	88	15	92	15	415	70	7	1
MET3	247	42	84	14	259	44	10	2	259	43	87	15	250	42	6	1
MET4	309	52	97	16	185	31	9	2	361	60	71	12	165	28	5	1
MET5	36	6	57	10	500	84	7	1	62	10	74	12	460	77	6	1
MET6	313	53	113	19	167	28	7	1	386	65	83	14	124	21	9	1
MET7	235	40	72	12	282	48	11	2	203	34	62	10	326	55	11	2
As You Work																
MET8	73	12	81	14	435	74	11	2	75	13	76	13	444	75	7	1
MET9	81	14	56	9	454	77	9	2	71	12	56	9	468	79	7	1
MET10	190	32	116	20	282	48	12	2	205	35	131	22	258	43	8	1
MET11	130	22	102	17	359	61	9	2	126	21	104	17	365	61	7	1
After You Finish																
MET12	92	15	89	15	413	70	6	1	108	18	96	16	391	66	7	1
MET13	101	17	91	15	401	68	7	1	114	19	78	13	401	68	9	1
MET14	162	27	86	15	345	58	7	1	193	32	94	16	307	52	8	1
MET15	91	15	77	13	425	72	7	1	134	22	100	17	362	61	6	1
MET16	385	65	90	15	118	20	7	1	430	72	74	12	90	15	8	1
Strategies Used																
MET17	205	35	30	5	359	60	6	1	108	18	28	5	461	77	5	1
MET18	447	77	59	10	77	13	17	3	497	84	56	9	40	7	9	1
MET19	112	19	91	15	385	65	12	2	162	27	103	17	327	55	10	2
MET20	344	58	122	21	123	21	11	2	429	72	100	17	64	11	9	1

School: TOTAL (Grades 7, 8)

Question Id	Grade Seven (N=600)												Grade Eight (N=602)											
	Very True		True		Sort Of True		Not Very True		Not At All True		Missing		Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
DURING CLASS																								
Beginning of Lesson																								
DURING1	159	27	232	39	182	30	20	3	6	1	1	0	155	26	222	37	191	32	25	4	7	1	2	0
DURING2	175	29	218	36	138	23	46	8	21	4	2	0	158	26	227	38	144	24	45	8	25	4	3	0
DURING3	206	35	202	34	146	24	29	5	14	2	3	1	171	29	215	36	173	29	31	5	10	2	2	0
DURING4	294	49	193	32	83	14	18	3	9	2	3	1	277	46	209	35	90	15	14	2	6	1	6	1
DURING5	290	48	187	31	79	13	28	5	14	2	2	0	312	52	184	31	76	13	22	4	7	1	1	0
DURING6	271	45	212	35	78	13	27	5	10	2	2	0	263	44	225	38	81	14	22	4	7	1	4	1
During Lesson																								
DURING7	137	23	225	38	146	24	57	10	33	6	2	0	131	22	175	29	180	30	69	12	45	8	2	0
DURING8	39	7	90	15	208	35	149	25	109	18	5	1	39	7	71	12	216	36	163	27	108	18	5	1
DURING9	222	37	251	42	94	16	17	3	14	2	2	0	193	32	277	46	91	15	17	3	19	3	5	1
DURING10	251	42	242	41	66	11	26	4	11	2	4	1	270	45	241	40	66	11	10	2	11	2	4	1
DURING11	162	27	135	23	135	23	73	12	91	15	4	1	158	26	132	22	157	26	84	14	67	11	4	1
DURING12	206	35	153	26	113	19	58	10	65	11	5	1	232	39	159	27	129	22	52	9	26	4	4	1
DURING13	86	14	100	17	130	22	118	20	160	27	6	1	90	15	101	17	139	23	123	21	147	25	2	0
DURING14	126	21	167	28	141	24	88	15	66	11	12	2	104	17	155	26	172	29	95	16	73	12	3	0
End of Lesson																								
DURING15	189	32	221	37	105	18	44	7	38	6	3	1	174	29	213	35	132	22	47	8	35	6	1	0
DURING16	152	26	223	38	121	20	58	10	39	7	7	1	157	26	189	32	164	27	48	8	40	7	4	1
DURING17	139	23	218	37	130	22	68	11	40	7	5	1	172	29	210	35	135	23	53	9	29	5	3	0
DURING18	118	20	174	29	134	23	95	16	74	12	5	1	111	19	137	23	195	33	92	15	63	11	4	1
DURING19	110	18	220	37	172	29	50	8	43	7	5	1	115	19	208	35	174	29	59	10	43	7	3	0

School TOTAL (Grades 7, 8)

Question Id	Grade Seven (N=600)												Grade Eight (N=602)											
	Very True		True		Sort Of True		Not Very True		Not At All True		Missing		Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
DURING CLASS																								
Other Thoughts and Feelings																								
DURING20	163	27	214	36	146	25	47	8	24	4	6	1	131	22	199	33	180	30	67	11	20	3	5	1
DURING21	61	10	101	17	83	14	111	19	229	39	15	3	27	5	59	10	111	19	139	24	255	43	11	2
DURING22	200	34	184	31	126	21	53	9	25	4	12	2	173	29	202	34	146	25	49	8	19	3	13	2
DURING23	172	29	134	23	144	25	50	9	85	15	15	3	129	22	134	23	170	29	73	12	87	15	9	1
DURING24	125	21	164	28	137	23	70	12	91	16	13	2	118	20	130	22	180	30	78	13	88	15	8	1
DURING25	36	6	45	8	73	13	135	23	292	50	19	3	23	4	35	6	68	12	158	27	306	52	12	2
DURING26	88	15	75	13	120	20	100	17	205	35	12	2	93	16	55	9	144	24	107	18	197	33	6	1
DURING27	90	15	68	12	121	21	100	17	207	35	14	2	67	11	66	11	111	19	121	20	230	39	7	1
DURING28	262	44	181	31	97	16	27	5	23	4	10	2	227	38	199	34	124	21	23	4	21	4	8	1
DURING29	73	12	54	9	133	23	156	26	175	30	9	2	51	9	66	11	111	19	198	33	170	29	6	1
DURING30	129	22	146	25	140	24	89	15	87	15	9	2	95	16	120	20	180	30	110	18	93	16	4	1
DURING31	59	10	90	15	96	16	158	27	181	31	16	3	35	6	76	13	119	20	184	31	178	30	10	2
DURING32	189	32	173	29	167	28	39	7	21	4	11	2	167	28	199	33	165	28	45	8	22	4	4	1
DURING33	30	5	44	8	95	16	143	24	272	47	16	3	25	4	35	6	90	15	170	29	276	46	6	1
DURING34	147	25	150	26	180	31	66	11	42	7	15	3	106	18	132	22	194	33	108	18	56	9	6	1
DURING35	129	22	147	25	140	24	79	14	89	15	16	3	116	19	135	23	155	26	95	16	94	16	7	1
DURING36	251	43	181	31	87	15	30	5	31	5	20	3	277	47	166	28	90	15	40	7	21	4	8	1
DURING37	115	20	125	21	172	30	101	17	70	12	17	3	99	17	122	21	178	30	121	21	69	12	13	2
DURING38	25	4	43	7	99	17	139	24	274	47	20	3	26	4	56	9	95	16	137	23	276	47	12	2
DURING39	88	15	72	12	118	20	106	18	202	34	14	2	81	14	69	12	112	19	119	20	214	36	7	1
DURING40	141	24	113	19	153	26	79	14	97	17	17	3	143	24	117	20	134	22	91	15	112	19	5	1
DURING41	116	20	142	24	144	24	102	17	85	14	11	2	76	13	145	24	189	32	109	18	79	13	4	1
DURING42	162	27	178	30	154	26	57	10	42	7	7	1	136	23	171	29	161	27	88	15	44	7	2	0
DURING43	197	33	171	29	129	22	65	11	31	5	7	1	153	26	184	31	150	25	73	12	36	6	6	1
DURING44	117	20	61	10	142	24	131	22	141	24	8	1	61	10	83	14	138	23	167	28	150	25	5	1
DURING45	129	22	193	33	186	31	56	9	27	5	9	2	102	17	197	33	193	32	86	14	19	3	5	1
DURING46	52	9	83	14	157	27	167	28	129	22	12	2	37	6	68	11	120	20	205	34	165	28	7	1
DURING47	194	33	191	32	136	23	45	8	27	5	7	1	140	24	221	37	143	24	66	11	25	4	7	1
DURING48	36	6	49	8	89	15	182	31	236	40	8	1	21	4	19	3	106	18	190	32	261	44	5	1
DURING49	127	21	125	21	148	25	100	17	92	16	8	1	137	23	130	22	108	18	131	22	94	16	2	0

School: TOTAL (Grades 7, 8)

Question Id.	Grade Seven (N=600)												Grade Eight (N=602)											
	Very True		True		Sort Of True		Not Very True		Not At All True		Missing		Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
WORKING WITH OTHERS																								
Before Beginning																								
WITHO1	230	38	197	33	112	19	42	7	18	3	1	0	177	29	212	35	143	24	37	6	33	5	0	0
WITHO2	218	36	237	40	94	16	32	5	17	3	2	0	216	36	224	37	118	20	36	6	8	1	0	0
WITHO3	60	10	135	23	147	25	116	20	136	23	6	1	52	9	129	22	149	25	139	23	127	21	6	1
WITHO4	89	15	158	27	141	24	96	16	110	19	6	1	114	19	189	32	135	23	91	15	67	11	6	1
WITHO5	54	9	96	16	146	25	143	24	156	26	5	1	58	10	117	20	146	25	149	25	125	21	7	1
WITHO6	107	18	163	27	117	20	100	17	108	18	5	1	133	22	174	29	129	21	83	14	82	14	1	0
WITHO7	125	21	153	26	120	20	85	14	113	19	4	1	119	20	167	28	150	25	91	15	73	12	2	0
While Working																								
WITHO8	98	16	190	32	133	22	83	14	90	15	6	1	123	21	214	36	130	22	70	12	62	10	3	0
WITHO9	57	10	132	22	148	25	122	21	135	23	6	1	64	11	142	24	135	23	150	25	105	18	6	1
WITHO10	88	15	158	27	141	24	90	15	116	20	7	1	96	16	205	34	144	24	73	12	78	13	6	1
WITHO11	113	19	186	32	122	21	82	14	85	14	12	2	141	24	211	35	128	21	69	12	49	8	4	1
WITHO12	93	16	143	24	133	23	92	16	124	21	15	3	97	16	168	28	143	24	100	17	88	15	6	1
WITHO13	147	25	211	36	122	21	71	12	42	7	7	1	152	25	217	36	152	25	53	9	23	4	5	1
WITHO14	204	34	198	33	112	19	50	8	29	5	7	1	189	32	235	39	107	18	49	8	19	3	3	0
WITHO15	113	19	157	27	159	27	93	16	66	11	12	2	96	16	163	27	189	32	92	16	53	9	9	1
After Working																								
WITHO16	132	22	178	30	120	20	72	12	91	15	7	1	151	25	188	31	130	22	75	13	54	9	4	1
WITHO17	144	25	202	34	126	22	63	11	51	9	14	2	157	26	215	36	135	23	60	10	29	5	6	1
WITHO18	167	28	214	36	103	17	54	9	52	9	10	2	182	30	230	38	125	21	41	7	20	3	4	1
WITHO19	118	20	185	31	127	21	69	12	94	16	7	1	131	22	187	31	143	24	71	12	63	11	7	1
WITHO20	109	18	181	31	132	22	79	13	89	15	10	2	135	23	187	31	134	22	84	14	56	9	6	1
WITHO21	97	16	170	29	125	21	99	17	101	17	8	1	103	17	173	29	144	24	95	16	79	13	8	1
WITHO22	127	22	238	40	143	24	50	9	30	5	12	2	145	25	223	38	150	26	44	7	26	4	14	2
WITHO23	158	27	236	40	129	22	41	7	29	5	7	1	141	24	247	42	141	24	48	8	17	3	8	1

School: TOTAL (Grades 7, 8)

Grade Seven (N=600)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
WORKING WITH OTHERS												
Other Thoughts and Feelings												
WITHO24	138	23	172	29	163	28	66	11	53	9	8	1
WITHO25	42	7	83	14	115	19	137	23	214	36	9	2
WITHO26	81	14	148	25	180	31	83	14	94	16	14	2
WITHO27	28	5	58	10	80	14	118	20	298	51	18	3
WITHO28	60	10	85	15	150	26	138	24	146	25	21	4
WITHO29	132	22	200	34	149	25	53	9	54	9	12	2
WITHO30	165	28	184	31	121	21	52	9	64	11	14	2
WITHO31	122	21	148	25	166	28	76	13	74	13	14	2
WITHO32	94	16	137	24	182	31	82	14	86	15	19	3
WITHO33	159	27	164	28	156	27	50	9	59	10	12	2
WITHO34	109	18	141	24	163	28	100	17	79	13	8	1
WITHO35	22	4	64	11	93	16	182	31	229	39	10	2
WITHO36	84	14	144	25	158	27	99	17	102	17	13	2
WITHO37	24	4	49	8	61	10	136	23	321	54	9	2
WITHO38	134	23	178	31	155	27	63	11	53	9	17	3
WITHO39	129	22	173	29	150	25	63	11	75	13	10	2
WITHO40	55	9	62	11	129	22	150	26	189	32	15	3
WITHO41	89	15	87	15	135	23	112	19	157	27	20	3
WITHO42	40	7	58	10	99	17	169	29	221	38	13	2
WITHO43	87	15	94	16	109	19	127	22	170	29	13	2
WITHO44	87	15	116	20	168	28	115	19	104	18	10	2
WITHO45	63	11	72	12	158	27	149	25	147	25	11	2
WITHO46	35	6	54	9	93	16	162	27	252	42	4	1
WITHO47	36	6	70	12	89	15	161	27	235	40	9	2
WITHO48	129	22	196	33	161	27	65	11	39	7	10	2
WITHO49	59	10	82	14	137	23	148	25	157	27	17	3
WITHO50	55	9	99	17	173	29	134	23	126	21	13	2
WITHO51	47	8	53	9	113	19	144	24	232	39	11	2
WITHO52	89	15	128	22	181	31	109	18	84	14	9	2
WITHO53	97	16	111	19	130	22	126	21	132	22	4	1

Grade Eight (N=602)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
WORKING WITH OTHERS												
Other Thoughts and Feelings												
WITHO24	132	22	195	33	156	26	70	12	44	7	5	1
WITHO25	35	6	59	10	110	19	173	29	217	37	8	1
WITHO26	62	11	138	23	182	31	129	22	78	13	13	2
WITHO27	20	3	54	9	65	11	143	24	312	53	8	1
WITHO28	44	8	77	13	144	25	172	29	148	25	17	3
WITHO29	135	23	213	36	159	27	53	9	31	5	11	2
WITHO30	148	25	191	32	141	24	69	12	47	8	6	1
WITHO31	128	22	180	30	152	26	76	13	58	10	8	1
WITHO32	84	14	117	20	172	29	135	23	80	14	14	2
WITHO33	151	25	197	33	139	23	60	10	46	8	9	1
WITHO34	90	15	135	23	148	25	129	22	87	15	13	2
WITHO35	10	2	49	8	101	17	223	38	206	35	13	2
WITHO36	92	16	103	18	189	32	119	20	85	14	14	2
WITHO37	14	2	40	7	46	8	148	25	340	58	14	2
WITHO38	136	23	187	32	148	25	71	12	41	7	19	3
WITHO39	123	21	158	27	160	28	88	15	51	9	22	4
WITHO40	43	7	68	12	113	19	170	29	189	32	19	3
WITHO41	87	15	81	14	142	24	135	23	138	24	19	3
WITHO42	28	5	41	7	101	17	207	36	201	35	24	4
WITHO43	50	9	91	16	110	19	160	28	169	29	22	4
WITHO44	75	13	115	20	163	28	135	23	96	16	18	3
WITHO45	54	9	82	14	145	25	178	30	131	22	12	2
WITHO46	21	4	43	7	81	14	202	34	242	41	13	2
WITHO47	36	6	53	9	90	15	179	31	227	39	17	3
WITHO48	133	23	197	34	189	32	44	8	22	4	17	3
WITHO49	44	8	76	13	160	27	164	28	138	24	20	3
WITHO50	43	7	101	17	197	34	147	25	98	17	16	3
WITHO51	36	6	65	11	84	14	140	24	259	44	18	3
WITHO52	82	14	123	21	190	33	119	20	69	12	19	3
WITHO53	74	13	120	20	138	23	129	22	130	22	11	2

Grade Seven (N=600)

Question Id	4 /Week N	4 /Week %	2-3 /Week N	2-3 /Week %	1 /Week N	1 /Week %	< 1 /Week N	< 1 /Week %	Never N	Never %	Missing N	Missing %
WORKING IN A GROUP												
INGRP	39	7	102	18	81	14	128	22	220	39	30	5

Grade Eight (N=602)

Question Id	4 /Week N	4 /Week %	2-3 /Week N	2-3 /Week %	1 /Week N	1 /Week %	< 1 /Week N	< 1 /Week %	Never N	Never %	Missing N	Missing %
WORKING IN A GROUP												
INGRP	40	7	95	17	57	10	197	34	185	32	28	5

School: TOTAL (Grades 7, 8)

Grade Seven (N=600)

Question Id	Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%
HOMEWORK												
Before Beginning												
HOMEWK1	183	31	156	26	106	18	67	11	87	15	1	0
HOMEWK2	107	18	137	23	88	15	122	20	144	24	2	0
HOMEWK3	239	40	178	30	105	18	40	7	35	6	3	1
While Working												
HOMEWK4	283	47	191	32	85	14	23	4	14	2	4	1
HOMEWK5	227	38	238	40	83	14	29	5	22	4	1	0
HOMEWK6	244	41	213	36	94	16	28	5	17	3	4	1
After Working												
HOMEWK7	109	18	140	24	151	25	91	15	104	17	5	1
HOMEWK8	166	28	190	32	142	24	53	9	49	8	0	0
HOMEWK9	82	14	123	21	139	23	111	19	144	24	1	0

Grade Eight (N=602)

Question Id	Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%
HOMEWORK												
Before Beginning												
HOMEWK1	170	28	165	28	117	20	67	11	80	13	3	0
HOMEWK2	87	15	124	21	112	19	125	21	147	25	7	1
HOMEWK3	209	35	183	31	123	21	44	7	39	7	4	1
While Working												
HOMEWK4	292	49	215	36	66	11	10	2	15	3	4	1
HOMEWK5	237	40	234	39	92	15	24	4	12	2	3	0
HOMEWK6	239	40	220	37	89	15	28	5	23	4	3	0
After Working												
HOMEWK7	106	18	145	24	144	24	107	18	94	16	6	1
HOMEWK8	172	29	201	34	133	22	59	10	32	5	5	1
HOMEWK9	70	12	101	17	166	28	132	22	129	22	4	1

School: TOTAL (Grades 7, 8)

	Grade Seven (N=600)												Grade Eight (N=602)											
Question Id	Very True		True		Sort Of True		Not Very True		Not At All True		Missing		Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
HOMEWORK																								
Other Thoughts and Feelings																								
HOMEWK10	40	7	56	9	88	15	147	25	266	45	3	1	31	5	48	8	93	16	194	33	227	38	9	1
HOMEWK11	45	8	77	13	140	24	154	26	178	30	6	1	29	5	67	11	164	28	165	28	167	28	10	2
HOMEWK12	64	11	62	11	121	21	117	20	226	38	10	2	54	9	61	10	123	21	167	29	179	31	16	3
HOMEWK13	39	7	60	10	104	18	138	23	251	42	8	1	27	5	64	11	109	19	169	29	219	37	14	2
HOMEWK14	141	24	106	18	129	22	97	16	120	20	7	1	148	25	122	21	131	22	87	15	103	17	11	2
HOMEWK15	99	17	117	20	155	26	108	18	118	20	3	1	84	14	120	20	159	27	124	21	103	17	12	2
HOMEWK16	24	4	56	9	58	10	143	24	313	53	6	1	24	4	56	10	71	12	168	29	269	46	14	2
HOMEWK17	176	30	199	33	141	24	54	9	26	4	4	1	149	25	192	32	181	30	47	8	25	4	8	1
HOMEWK18	70	12	105	18	192	32	97	16	129	22	7	1	75	13	103	17	158	27	106	18	150	25	10	2
HOMEWK19	61	10	71	12	142	24	132	22	184	31	10	2	46	8	57	10	134	23	144	24	210	36	11	2
HOMEWK20	116	19	158	27	195	33	73	12	53	9	5	1	114	19	158	27	193	32	69	12	60	10	8	1
HOMEWK21	31	5	48	8	77	13	167	28	272	46	5	1	36	6	52	9	72	12	181	31	251	42	10	2
HOMEWK22	204	34	198	33	134	22	34	6	27	5	3	1	178	30	195	33	160	27	46	8	20	3	3	0
HOMEWK23	122	21	136	23	155	26	78	13	104	17	5	1	112	19	130	22	160	27	107	18	87	15	6	1
HOMEWK24	43	7	75	13	67	11	146	25	259	44	10	2	27	5	53	9	63	11	193	33	256	43	10	2
HOMEWK25	124	21	191	32	172	29	64	11	40	7	9	2	116	19	173	29	192	32	72	12	42	7	7	1
HOMEWK26	151	25	172	29	140	23	67	11	67	11	3	1	144	24	175	29	158	27	65	11	53	9	7	1
HOMEWK27	46	8	84	14	150	25	149	25	161	27	10	2	43	7	76	13	174	29	169	29	128	22	12	2
HOMEWK28	82	14	114	19	169	28	115	19	114	19	6	1	67	11	107	18	189	32	132	22	100	17	7	1
HOMEWK29	143	24	137	23	141	24	87	15	83	14	9	2	128	22	143	24	131	22	113	19	76	13	11	2
HOMEWK30	50	8	92	16	136	23	168	28	144	24	10	2	37	6	69	12	156	26	161	27	170	29	9	1
HOMEWK31	115	19	152	26	158	27	84	14	81	14	10	2	101	17	149	25	172	29	102	17	64	11	14	2
HOMEWK32	69	12	127	21	184	31	114	19	99	17	7	1	74	13	110	19	219	37	115	19	72	12	12	2
HOMEWK33	104	17	101	17	147	25	113	19	130	22	5	1	96	16	113	19	148	25	116	19	122	21	7	1
HOMEWK34	130	22	85	14	172	29	115	19	94	16	4	1	127	21	95	16	165	28	119	20	89	15	7	1
HOMEWK35	40	7	47	8	86	14	153	26	270	45	4	1	44	7	42	7	76	13	173	29	265	44	2	0
HOMEWK36	185	31	189	32	89	15	60	10	73	12	4	1	205	34	172	29	106	18	67	11	52	9	0	0
HOMEWK37	128	22	178	30	193	33	53	9	33	6	15	3	113	19	174	29	229	38	60	10	20	3	6	1
HOMEWK38	23	4	35	6	66	11	159	27	311	52	6	1	20	3	38	6	63	11	183	31	296	49	2	0
HOMEWK39	85	14	61	10	93	16	121	20	236	40	4	1	60	10	53	9	96	16	165	28	222	37	6	1

Mathematics Assessment Questionnaire: A Survey of Thoughts and Feelings, for Students in Grades 7-9

School: TOTAL (Grade 9)

Grade Nine (N=535)

Question Id	No N	No %	Maybe N	Maybe %	Yes N	Yes %	Missing N	Missing %
WORKING A MATH PROBLEM								
Before You Begin								
MET1	29	5	29	5	477	89	0	0
MET2	64	12	111	21	354	67	6	1
MET3	225	42	72	14	234	44	4	1
MET4	330	62	68	13	133	25	4	1
MET5	40	8	66	12	424	80	5	1
MET6	300	56	106	20	125	24	4	1
MET7	150	28	67	13	311	59	7	1
As You Work								
MET8	72	14	61	12	393	75	9	2
MET9	55	10	49	9	425	80	6	1
MET10	186	35	101	19	239	45	9	2
MET11	88	17	107	20	338	63	2	0
After You Finish								
MET12	80	15	93	17	359	67	3	1
MET13	84	16	74	14	372	70	5	1
MET14	175	33	95	18	259	49	6	1
MET15	97	18	81	15	349	66	8	1
MET16	374	71	67	13	88	17	6	1
Strategies Used								
MET17	128	24	31	6	372	70	4	1
MET18	432	83	52	10	39	7	12	2
MET19	122	23	99	19	303	58	11	2
MET20	353	67	96	18	76	14	10	2

Mathematics Assessment Questionnaire: A Survey of Thoughts and Feelings, for Students in Grades 7-9

School: TOTAL (Grade 9)

Grade Nine (N=535)

Question Id	Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%
DURING CLASS												
Beginning of Lesson												
DURING1	123	23	194	36	187	35	22	4	6	1	3	1
DURING2	130	25	194	37	141	27	48	9	17	3	5	1
DURING3	143	27	190	36	170	32	26	5	5	1	1	0
DURING4	209	39	202	38	89	17	23	4	8	2	4	1
DURING5	247	46	192	36	62	12	22	4	10	2	2	0
DURING6	224	42	224	42	55	10	18	3	11	2	3	1
During Lesson												
DURING7	101	19	179	34	160	30	67	13	27	5	1	0
DURING8	21	4	66	12	167	31	173	32	106	20	2	0
DURING9	151	28	241	45	107	20	20	4	13	2	3	1
DURING10	202	38	241	45	74	14	12	2	4	1	2	0
DURING11	135	25	126	24	124	23	81	15	69	13	0	0
DURING12	160	30	142	27	128	24	60	11	44	8	1	0
DURING13	51	10	72	14	112	21	124	23	172	32	4	1
DURING14	89	17	111	21	167	31	93	18	71	13	4	1
End of Lesson												
DURING15	169	32	183	34	118	22	36	7	29	5	0	0
DURING16	138	26	188	35	133	25	49	9	26	5	1	0
DURING17	128	24	187	35	122	23	67	13	30	6	1	0
DURING18	94	18	145	27	142	27	83	16	70	13	1	0
DURING19	98	18	178	33	161	30	62	12	34	6	2	0

School: TOTAL (Grade 9)

Grade Nine (N=535)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
DURING CLASS												
Other Thoughts and Feelings												
DURING20	93	17	153	29	193	36	60	11	33	6	3	1
DURING21	33	6	65	12	95	18	137	26	191	37	14	3
DURING22	145	27	190	36	132	25	32	6	29	5	7	1
DURING23	88	17	113	21	157	30	80	15	91	17	6	1
DURING24	70	13	111	21	172	32	95	18	82	15	5	1
DURING25	18	3	32	6	73	14	148	28	252	48	12	2
DURING26	99	19	69	13	125	24	114	21	124	23	4	1
DURING27	62	12	66	12	118	22	101	19	185	35	3	1
DURING28	182	35	165	31	128	24	42	8	10	2	8	1
DURING29	55	10	45	8	129	24	181	34	121	23	4	1
DURING30	75	14	118	22	144	27	124	23	73	14	1	0
DURING31	37	7	64	12	145	27	162	30	125	23	2	0
DURING32	132	25	192	36	142	27	43	8	21	4	5	1
DURING33	25	5	52	10	88	17	185	35	181	34	4	1
DURING34	71	13	138	26	148	28	122	23	50	9	6	1
DURING35	71	13	109	21	149	28	110	21	90	17	6	1
DURING36	253	48	141	27	83	16	31	6	19	4	8	1
DURING37	89	17	107	20	157	30	113	21	61	12	8	1
DURING38	33	6	54	10	109	21	133	25	199	38	7	1
DURING39	73	14	52	10	122	23	111	21	173	33	4	1
DURING40	145	27	134	25	125	24	75	14	52	10	4	1
DURING41	60	11	123	23	187	35	111	21	50	9	4	1
DURING42	98	18	157	30	177	33	69	13	31	6	3	1
DURING43	148	28	179	34	125	24	66	12	12	2	5	1
DURING44	71	13	77	15	129	24	153	29	98	19	7	1
DURING45	91	17	153	29	184	35	83	16	18	3	6	1
DURING46	26	5	60	11	131	25	180	34	128	24	10	2
DURING47	127	24	176	33	148	28	52	10	23	4	9	2
DURING48	20	4	33	6	99	19	190	36	189	36	4	1
DURING49	74	14	106	20	118	22	120	23	113	21	4	1

Mathematics Assessment Questionnaire: A Survey of Thoughts and Feelings, for Students in Grades 7-9

School: TOTAL (Grade 9)

Grade Nine (N=535)

Question Id	Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%
WORKING WITH OTHERS												
Before Beginning												
WITHO1	160	30	198	37	122	23	36	7	18	3	1	0
WITHO2	176	33	214	40	93	18	32	6	16	3	4	1
WITHO3	42	8	90	17	136	26	150	28	112	21	5	1
WITHO4	84	16	162	31	133	25	84	16	66	12	6	1
WITHO5	27	5	104	20	142	27	146	27	114	21	2	0
WITHO6	95	18	172	32	105	20	83	16	77	14	3	1
WITHO7	92	17	163	31	126	24	82	15	71	13	1	0
While Working												
WITHO8	84	16	193	36	129	24	73	14	54	10	2	0
WITHO9	41	8	123	23	148	28	124	23	96	18	3	1
WITHO10	77	14	176	33	141	27	76	14	62	12	3	1
WITHO11	106	20	208	39	102	19	74	14	43	8	2	0
WITHO12	91	17	142	27	117	22	98	18	83	16	4	1
WITHO13	106	20	222	42	122	23	48	9	32	6	5	1
WITHO14	150	28	214	40	99	19	47	9	23	4	2	0
WITHO15	73	14	148	28	151	29	91	17	62	12	10	2
After Working												
WITHO16	103	19	195	37	111	21	66	12	58	11	2	0
WITHO17	122	23	213	40	128	24	47	9	21	4	4	1
WITHO18	138	26	248	47	88	17	44	8	13	2	4	1
WITHO19	85	16	200	38	115	22	83	16	48	9	4	1
WITHO20	75	14	209	39	133	25	70	13	46	9	2	0
WITHO21	67	13	162	31	125	24	99	19	76	14	6	1
WITHO22	92	18	206	39	151	29	47	9	28	5	11	2
WITHO23	112	21	217	41	139	26	40	8	20	4	7	1

Mathematics Assessment Questionnaire: A Survey of Thoughts and Feelings, for Students in Grades 7-9

School: TOTAL (Grade 9)

Grade Nine (N=535)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
WORKING WITH OTHERS												
Other Thoughts and Feelings												
WITHO24	114	21	176	33	140	26	63	12	40	8	2	0
WITHO25	27	5	51	10	94	18	166	32	187	36	10	2
WITHO26	43	8	128	24	166	31	122	23	68	13	8	1
WITHO27	23	4	42	8	71	13	156	29	238	45	5	1
WITHO28	38	7	70	13	156	30	127	24	134	26	10	2
WITHO29	106	20	206	39	137	26	49	9	30	6	7	1
WITHO30	118	22	178	34	120	23	70	13	42	8	7	1
WITHO31	101	19	167	31	147	28	80	15	37	7	3	1
WITHO32	55	10	99	19	176	33	137	26	65	12	3	1
WITHO33	134	25	167	31	135	25	56	11	39	7	4	1
WITHO34	70	13	122	23	168	32	115	22	57	11	3	1
WITHO35	16	3	48	9	86	16	211	40	170	32	4	1
WITHO36	77	15	102	19	152	29	112	21	86	16	6	1
WITHO37	14	3	28	5	45	8	145	27	298	56	5	1
WITHO38	91	17	200	38	140	27	49	9	42	8	13	2
WITHO39	98	19	157	30	143	27	82	16	49	9	6	1
WITHO40	41	8	52	10	108	20	172	33	156	29	6	1
WITHO41	66	13	75	14	160	30	115	22	110	21	9	2
WITHO42	21	4	45	9	111	21	170	32	179	34	9	2
WITHO43	68	13	64	12	131	25	128	24	135	26	9	2
WITHO44	57	11	90	17	153	29	135	25	95	18	5	1
WITHO45	35	7	62	12	179	34	154	29	99	19	6	1
WITHO46	26	5	53	10	67	13	187	35	195	37	7	1
WITHO47	30	6	58	11	83	16	155	29	200	38	9	2
WITHO48	102	19	199	38	153	29	47	9	25	5	9	2
WITHO49	34	6	87	16	139	26	164	31	106	20	5	1
WITHO50	49	9	99	19	164	31	130	25	86	16	7	1
WITHO51	31	6	44	8	101	19	142	27	211	40	6	1
WITHO52	59	11	93	18	193	37	110	21	69	13	11	2
WITHO53	79	15	109	21	117	22	121	23	104	20	5	1

Question Id	4 /Week N	4 /Week %	2-3 /Week N	2-3 /Week %	1 /Week N	1 /Week %	< 1 /Week N	< 1 /Week %	Never N	Never %	Missing N	Missing %
WORKING IN A GROUP												
INGRP	35	7	78	15	55	10	170	32	191	36	6	1

School: TOTAL (Grade 9)

Grade Nine (N=535)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
HOMEWORK												
Before Beginning												
HOMEWK1	144	27	175	33	109	21	57	11	46	9	4	1
HOMEWK2	79	15	121	23	96	18	117	22	116	22	6	1
HOMEWK3	160	30	208	39	109	21	34	6	20	4	4	1
While Working												
HOMEWK4	246	46	205	39	66	12	11	2	4	1	3	1
HOMEWK5	197	37	233	44	68	13	18	3	14	3	5	1
HOMEWK6	189	36	214	41	82	16	24	5	17	3	9	2
After Working												
HOMEWK7	103	19	151	28	121	23	94	18	63	12	3	1
HOMEWK8	132	25	190	36	127	24	42	8	39	7	5	1
HOMEWK9	61	11	103	19	138	26	128	24	102	19	3	1

School: TOTAL (Grade 9)

Grade Nine (N=535)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
HOMEWORK												
Other Thoughts and Feelings												
HOMEWK10	29	5	29	5	83	16	178	33	214	40	2	0
HOMEWK11	28	5	54	10	150	28	157	30	141	27	5	1
HOMEWK12	52	10	54	10	128	24	131	25	158	30	12	2
HOMEWK13	26	5	47	9	98	19	179	34	177	34	8	1
HOMEWK14	155	29	99	19	110	21	85	16	83	16	3	1
HOMEWK15	74	14	108	20	143	27	124	23	81	15	5	1
HOMEWK16	23	4	36	7	61	12	166	31	243	46	6	1
HOMEWK17	129	24	212	40	128	24	35	7	25	5	6	1
HOMEWK18	52	10	67	13	143	27	114	22	150	29	9	2
HOMEWK19	44	8	60	11	126	24	140	26	161	30	4	1
HOMEWK20	101	19	121	23	176	34	84	16	43	8	10	2
HOMEWK21	32	6	30	6	89	17	191	36	189	36	4	1
HOMEWK22	136	26	162	31	163	31	45	8	25	5	4	1
HOMEWK23	82	16	117	22	142	27	112	21	76	14	6	1
HOMEWK24	26	5	40	8	85	16	174	33	205	39	5	1
HOMEWK25	100	19	173	33	158	30	60	11	37	7	7	1
HOMEWK26	108	20	150	28	131	25	85	16	54	10	7	1
HOMEWK27	45	9	65	12	141	27	175	33	100	19	9	2
HOMEWK28	47	9	86	16	160	30	123	23	110	21	9	2
HOMEWK29	105	20	141	27	136	26	81	16	56	11	16	3
HOMEWK30	34	6	67	13	167	32	149	28	110	21	8	1
HOMEWK31	85	16	113	21	156	30	107	20	67	13	7	1
HOMEWK32	58	11	113	21	186	35	98	19	71	13	9	2
HOMEWK33	75	14	98	19	143	27	100	19	112	21	7	1
HOMEWK34	118	22	85	16	152	28	101	19	72	14	7	1
HOMEWK35	32	6	36	7	99	19	168	32	198	37	2	0
HOMEWK36	171	32	175	33	95	18	50	9	38	7	6	1
HOMEWK37	97	19	142	27	193	37	73	14	19	4	11	2
HOMEWK38	23	4	31	6	52	10	162	31	263	50	4	1
HOMEWK39	45	9	55	10	104	20	159	30	166	31	6	1

Appendix 3-2

Preliminary Results of Teacher Ratings: Number and Percentage of Teachers Rating Metacognitive Statements as Appropriate for the Coin Problem.

BEFORE YOU WORK THE PROBLEM	Number of Teachers	Percentage
1. I read the problem more than once.	4/4	100%
2. I thought to myself, Do I understand what the question is asking me?	4/4	100%
3. I tried to put the problem into my own words.	3/4	75%
4. I tried to remember if I had worked a problem like this before.	2/4	50%
5. I thought about what information I needed to solve the problem.	4/4	100%
6. I asked myself, Is there information in this problem that I don't need?	2/4	50%
7. I wrote down important information.	3/4	75%
AS YOU WORKED THE PROBLEM		
8. I thought about all the steps as I worked the problem.	4/4	100%
9. I kept looking back at the problem after I did a step.	4/4	100%
10. I had to stop and rethink a step I had already done.	3/4	75%
11. I checked my work step-by-step as I worked the problem.	4/4	100%

Appendix 3-2 (continued)

AFTER YOU FINISHED WORKING THE PROBLEM	Number of Teachers	Percentage
12. I looked back to see if I did the correct procedures.	4/4	100%
13. I checked to see if my calculations were correct.	4/4	100%
14. I went back and checked my work again.	3/4	75%
15. I looked back at the problem to see if my answer made sense.	3/4	75%
16. I thought about a different way to solve the problem.	3/4	75%
DID YOU USE ANY OF THESE WAYS OF WORKING		
17. I drew a picture to help me understand the problem.	4/4	100%
18. I "guessed and checked."	0/4	0%
19. I picked out the operations I needed to do this problem.	1/4	25%
20. I felt confused and could not decide what to do.	4/4	100%

Appendix 3-3

Statement Numbers, Scale Response Numbers for Indicators, and Interpretation of Diagnostic Indictors for Beliefs, Motivations and Attribution Categories

Thoughts & Feelings	Activity Setting During Class	 Working W/Others	 Homework	Interpretation
Value	26(R)* 28 34	32 44 46(R)	12(R) 20 39(R)	4 or 5 indicates low value
Interest	24 44(R) 49	30 36 40(R)	18 28 34(R)	4 or 5 indicates low interest
Confidence	20 31(R) 48(R)	24 27(R) 48	13(R) 22 35(R)	4 or 5 indicates low confidence
Anxiety	27 35(R) 39	25 31(R) 51	19 26(R) 36(R)	1 or 2 indicates high anxiety
Internal Learning Goals	30 32 42	29 33 39	15 23 31	4 or 5 indicates not inter. motivated
External Performance Goals	25 36 40	37 43 53	14 29 33	1 or 2 indicates exter. motivated
Internal Stable Uncontrollable	22 37 41	26 38 52	10 16 38	1 or 2 indicates internal stable uncontrol
Internal Stable Controllable	43 45 47	34 41 49	17 25 37	4 or 5 indicates internal stable uncontrol

Appendix 3-3 (continued)

External	23	35	21	1 or 2
Stable	29	45	27	indicates external
Uncontrollable	46	50	32	stable uncontrol.
Unknown	21	28	11	1 or 2
Control	33	42	24	indicates unknown
	38	47	30	sense of control.

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*Where an (R) appears, the opposite end of a scale, the reverse is counted: e.g., for confidence a 4 or 5 indicates low confidence and the (R) next to 31 indicates that the reverse end, a 1 or 2 is counted as an indicator of low confidence. See Appendix 4-2 for hand tally forms.

Appendix 4-1
Source Questionnaire: Classification of Statements

NAME________________________________ TODAY'S DATE ____________

SCHOOL______________________________ GRADE ___________________

TEACHER'S NAME______________________ PERIOD__________________

CIRCLE: BOY GIRL YOUR AGE _________________

WHICH BEST DESCRIBES YOU: ASIAN BLACK HISPANIC WHITE OTHER

The questions in this booklet ask about what you think and feel about doing math word problems. This is not a test. YOU DO NOT HAVE TO ANSWER ANY QUESTION YOU DO NOT WANT TO. This is just a way to get your ideas about math. You will not be graded on your answers and the information will not affect your grades or school work. Please answer each question carefully. Be sure to answer BOTH sides of each page.

SOURCE QUESTIONNAIRE

Items classified as written

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PART I

First solve the problem. Use the space below to work on the problem. Then answer the statements about what you thought and did as you worked the problem.

Eight pennies are arranged in a row on a table. Every other coin is replaced with a nickel. Then, every third coin is replaced with a dime. Finally, every fourth coin is replaced with a quarter. What is the total value of the coins on the table?

Now go to the next page and say what you did.

BEFORE YOU BEGAN TO SOLVE THE PROBLEM - WHAT DID YOU DO? Try to think of exactly what you did. Circle the answer that best describes what you think you did.

NO	MAYBE	YES
No, I didn't do this	I may have done this	Yes, I did do this

1. I read the problem more than once. NO MAYBE YES
2. I thought to myself, Do I understand what the question is asking me? NO MAYBE YES
3. I tried to put the problem into my own words. NO MAYBE YES
4. I tried to remember if I had worked a problem like this before. NO MAYBE YES
5. I thought about what information I needed to solve this problem. NO MAYBE YES
6. I asked myself, Is there information in this problem that I don't need? NO MAYBE YES
7. I wrote down important information. NO MAYBE YES

AS YOU WORKED THE PROBLEM - WHAT DID YOU DO? Circle the answer that best describes what you think you did.

8. I thought about all the steps as I worked the problem. NO MAYBE YES
9. I kept looking back at the problem after I did a step. NO MAYBE YES
10. I had to stop and rethink a step I had already done. NO MAYBE YES
11. I checked my work step-by-step as I worked the problem. NO MAYBE YES

AFTER YOU FINISHED WORKING THE PROBLEM - WHAT DID YOU DO? Circle the answer that best describes what you think you did.

	NO No, I didn't do this	MAYBE I may have done this	YES Yes, I did do this
12. I looked back to see if I did the correct procedures.	NO	MAYBE	YES
13. I checked to see if my calculations were correct.	NO	MAYBE	YES
14. I went back and checked my work again.	NO	MAYBE	YES
15. I looked back at the problem to see if my answer made sense.	NO	MAYBE	YES
16. I thought about a different way to solve the problem.	NO	MAYBE	YES

DID YOU USE ANY OF THESE WAYS OF WORKING? Circle the answer that best describes what you think you did.

17. I drew a picture to help me understand the problem.	NO	MAYBE	YES
18. I "guessed and checked."	NO	MAYBE	YES
19. I picked out the operations I needed to do this problem.	NO	MAYBE	YES
20. I felt confused and could not decide what to do.	NO	MAYBE	YES

PART II

INSTRUCTIONS

WHAT HAPPENS WHEN YOU WORK WORD PROBLEMS IN VARIOUS SETTINGS -- at school, in a group, at home?

How true is each statement for you? Circle your answer: (1) if very true, (2) if true, (3) if sort of true, (4) if not very true, or (5) if not at all true.

DURING CLASS

Think about when your teacher teaches about word problems. What do you do before the lesson begins, during the lesson, and after the lesson? Try to think of exactly what you do. How true is each statement for you? Circle your answer.

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

AT THE BEGINNING OF A MATH LESSON ABOUT WORD PROBLEMS:

1. I get ready to listen carefully.	1	self reg	5
2. I make sure I have all the materials I need.	1	self reg	5
3. I make sure I am paying attention.	1	self reg	5
4. I know when the teacher is reviewing material already taught.	1	self reg	5
5. I know when the teacher is beginning a new math idea.	1	self reg	5
6. I know when the teacher is giving me practice in new math problems.	1	self reg	5

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

DURING A MATH LESSON ABOUT WORD PROBLEMS:

7.	I think about what is important to learn in the lesson.	1	self reg	5
8.	I know what the teacher is going to do next in the lesson.	1	self reg	5
9.	I think of an answer to a question the teacher is asking.	1	self reg	5
10.	I think about whether I understand an example the teacher puts on the board.	1	self reg	5
11.	When my math teacher makes a mistake, I say something about the error.	1	self reg	5
12.	I ask my math teacher to explain a problem again that I do not understand.	1	self reg	5
13.	When I can think of another way to solve a word problem, I volunteer to show the class.	1	self reg	5
14.	I know when the teacher is about to end the lesson or topic.	1	self reg	5

AT THE END OF A MATH LESSON ABOUT WORD PROBLEMS:

15.	I ask myself if I understand the lesson.	1	self reg	5
16.	I try to figure out if I need to do more to learn the lesson.	1	self reg	5
17.	I decide if I need to ask the teacher a question about the lesson.	1	self reg	5
18.	I review the word problems my teacher did.	1	self reg	5
19.	When I review word problems from class, I evaluate if I understood the lesson.	1	self reg	5

DURING CLASS

Think about when your teacher teaches about word problems. What do you think and feel? How true is each statement for you? Circle your answer.

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

20. I feel confident that I will be able to follow any word problem my math teacher explains in class.	1	confidence	5
21. When I correctly answer a question my teacher asks about word problems, I usually do not know why I get it right.	1	unkn control	5
22. If I correctly answer a question my teacher asks about word problems, it is because I have the ability to learn math.	1	ISU	5
23. If I understand the word problems my teacher does on the board, it is because I have a good teacher.	1	ESU	5
24. I enjoy trying to answer the math word problems my teacher asks in class.	1	interest	5
25. I only answer questions about word problems in math class to please my teacher.	1	EPG	5
26. Even when I listen to my teacher, I cannot understand how learning to solve word problems will help me in my everyday life.	1	value	5
27. I am afraid when I have to ask my math teacher a question about a word problem during class.	1	anxiety	5
28. It is important to learn to do the types of word problems my teacher explains in class.	1	value	5
29. If I am able to solve a word problem on the board, it is because the problem was easy.	1	ESU	5

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

DURING CLASS:

30. I volunteer to do word problems on the board so I can learn something more about math.	1	ILG	5
31. I do not expect to be able to answer the questions my math teacher asks about word problems.	1	confidence	5
32. I pay attention during my teacher's lessons on word problems because it helps me learn math.	1	ILG	5
33. I usually do not know what is going on when my teacher is explaining a word problem.	1	unkn control	5
34. Listening to my math teacher explain word problems during class helps me see how important math is.	1	value	5
35. When I am in math class, I usually feel very much at ease and relaxed.	1	anxiety	5
36. I pay attention when my teacher explains word problems if I know I will have a test on them.	1	EPG	5
37. If I can follow my teacher's explanation for word problems, it is because I am smart.	1	ISU	5
38. I do not know why I cannot follow the word problems my teacher works on the board.	1	unkn control	5
39. I get scared when I have to work a word problem on the board.	1	anxiety	5
40. I volunteer to do a word problem on the board if I think it will help my grade.	1	EPG	5
41. If I can solve a word problem the teacher puts on the board, it is because I think mathematically.	1	ISU	5

1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True

DURING CLASS:

42. I volunteer to answer questions about word problems in math class because it helps me understand the math.	1	ILG	5
43. If I understand a word problem my teacher is explaining, it is because I am trying as hard as I can.	1	ISC	5
44. I get bored when other students are working word problems on the board in math class.	1	interest	5
45. The next time my math teacher explains a word problem to the class, I expect to understand because I always listen carefully.	1	ISC	5
46. If I correctly answer a question the teacher asks about a word problem, it is because the teacher picks good problems.	1	ESU	5
47. Because I pay attention, I know I will be able to understand the word problems my teacher explains in class.	1	ISC	5
48. If my math teacher asks me to solve a word problem on the board, I am sure I will get the wrong answer.	1	confidence	5
49. I like to do new word problems by myself, even before the teacher explains them.	1	interest	5

WITH OTHER STUDENTS

Think about solving a word problem with a group of other students. If you have never solved a word problem with other students, imagine what it would be like. What do you do before beginning to work, as you work and after you are done? Try to think of exactly what you do. How true is each statement for you? Circle your answer.

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

BEFORE BEGINNING TO SOLVE A WORD PROBLEM WITH OTHER STUDENTS:

1. I make sure I have all the materials I will need. 1 self reg 5
2. I try to work the problem by myself first. 1 self reg 5
3. I think about how long it will take us so we can plan our time. 1 self reg 5
4. I say to the other students what I think the problem is asking. 1 self reg 5
5. I say to the other students how the problem is like other problems I have worked. 1 self reg 5
6. I say to the other students what I think we should do first. 1 self reg 5
7. I say to the other students what information we need to use to work the problem. 1 self reg 5

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

WHILE WORKING A WORD PROBLEM WITH OTHER STUDENTS:

8. I say to the other students if I think something should be worked differently. 1 self reg 5
9. I talk to the other students about how other problems are like the one we are working on. 1 self reg 5
10. I ask the other students questions about the problem. 1 self reg 5
11. I explain to the other students why I think my answer or procedure is right. 1 self reg 5
12. I encourage the other students to work on the problem too. 1 self reg 5
13. I listen carefully to what everyone says about the problem. 1 self reg 5
14. I keep looking back at the problem to make certain we are doing what we need to do. 1 self reg 5
15. I keep track of what everyone says. 1 self reg 5

AFTER DOING A WORD PROBLEM WITH OTHER STUDENTS:

16. We check each other's ideas. 1 self reg 5
17. I look over all the work we did to see if we used the right procedures. 1 self reg 5
18. I check to see if our calculations are right. 1 self reg 5
19. I ask the other students whether anyone thinks the answer is wrong. 1 self reg 5
20. I say to the other students whether I think the answer makes sense. 1 self reg 5
21. I ask the other students if anyone has a different way to solve the problem. 1 self reg 5
22. I know if I learned ways to do the word problem. 1 self reg 5
23. I know if I will be able to solve word problems like this. 1 self reg 5

WITH OTHER STUDENTS

What do you think and feel about doing word problems with other students? How true is each statement for you? Circle your answer.

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

24.	If I worked with other students, I am sure I could solve most math word problems.	1	confidence	5
25.	I dread the thought of trying to solve a math word problem with other students.	1	anxiety	5
26.	If I solve a word problem working with other students, it is because we think mathematically.	1	ISU	5
27.	I have no confidence in my ability to solve a word problem with other students.	1	confidence	5
28.	If I could not solve a word problem with others students, I would have no idea why we could not solve it.	1	unkn control	5
29.	I would work hard on a word problem with other students because it would help me understand how to do the problems.	1	ILG	5
30.	I think it would be interesting to work on a math word problem with other students.	1	interest	5
31.	I feel comfortable when I work on a word problem with other students.	1	anxiety	5
32.	If I work with other students on a word problem I see how useful math is.	1	value	5
33.	I would work hard on a word problem with other students if I could learn more math that way.	1	ILG	5

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

WITH OTHER STUDENTS:

34. If I cannot solve a word problem with other students, it is because we did not try as hard as we could on the problem.	1	ISC	5
35. If I cannot solve a math word problem with a group of students, it is because the problem is too long.	1	ESU	5
36. I would find math interesting if I worked on a word problem with a group of students.	1	interest	5
37. I would work on a word problem with other students only if my friends told me I should.	1	EPG	5
38. If I can solve a word problem with other students, it is because we have enough ability.	1	ISU	5
39. I would like to try and solve a challenging word problem with other students because I would learn a lot.	1	ILG	5
40. Word problems would not be interesting to me if I did them with a group of students.	1	interest	5
41. If I cannot solve a word problem with other students, it is because we fooled around.	1	ISC	5
42. When I solve a word problem with other students I am never sure how we solved the problem.	1	unkn control	5
43. I would work on a word problem with other students only if I could get a better math grade.	1	EPG	5
44. Word problems seem more important when I am working hard on them with other students.	1	value	5

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

WITH OTHER STUDENTS:

45. If I cannot solve a math word problem with a group of students, it is because the teacher did not give us a problem like that before. 1 ESU 5

46. If I worked a word problem with other students, I would see that the problem is a waste of time. 1 value 5

47. If I could solve a word problem with other students, I would not know why we got it right. 1 unkn control 5

48. If I worked on a word problem with other students, I know I would be able to help to solve the problem. 1 confidence 5

49. If I cannot solve a word problem working with other students, it is because we were careless. 1 ISC 5

50. If I cannot solve a math word problem with a group of students, it is because the problem was hard. 1 ESU 5

51. I feel nervous when I work on a word problem with other students. 1 anxiety 5

52. If I solve a word problem working with other students, it is because we are smart. 1 ISU 5

53. I would work on a word problem with other students only if I was told to by my teacher. 1 EPG 5

54. How often do you work word problems with other students? Check the box with your answer.

☐ 4 or more times a week

☐ 2-3 times a week

☐ once a week

☐ less than once a week

☐ I've never worked with other students

HOMEWORK

Think about when you work word problems for homework. What do you do before you begin, as you work and after you are done? How true is each statement for you? Circle your answer.

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

BEFORE YOU BEGIN TO WORK THE HOMEWORK WORD PROBLEMS:

1. I decide when is the best time to do my math homework word problems. 1 self reg 5

2. I decide how much time to spend on my math homework word problems. 1 self reg 5

3. I make sure I have all the materials I need. 1 self reg 5

WHILE WORKING THE HOMEWORK WORD PROBLEMS:

4. I read each problem carefully. 1 self reg 5

5. I keep track of my work as I am doing a homework word problem. 1 self reg 5

6. I make sure I try every problem, even if I cannot solve them all. 1 self reg 5

AFTER WORKING THE HOMEWORK WORD PROBLEMS:

7. If I cannot do the word problems, I write out all the steps I can do and bring them to class. 1 self reg 5

8. If I do not understand the homework word problems, I ask the teacher to explain them. 1 self reg 5

9. I review my homework word problems before class. 1 self reg 5

HOMEWORK

Think about when you work word problems for homework. What do you think and feel? How true is each statement for you? Circle your answer.

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

10. If I am not able to do my next math homework word problems, it is because I am not clever in math.	1	ISU	5
11. When I cannot do my math homework word problems, I usually do not know why.	1	unkn control	5
12. I do not see any use for the word problems I get for homework.	1	value	5
13. I never expect to be able to do the types of word problems I get for math homework.	1	confidence	5
14. The only reason I would do extra homework problems is if I could get extra credit.	1	EPG	5
15. I do not like to do word problems for homework unless I can learn something new by doing them.	1	ILG	5
16. I will not be able to do my next homework word problems because I do not have the ability to do them.	1	ISU	5
17. If I am able to do word problems for homework, it is because I listen in class.	1	ISC	5
18. I like working on math homework word problems.	1	interest	5
19. I feel nervous when I think about doing hard word problems for homework.	1	anxiety	5
20. Being good at solving homework word problems which involve math or reasoning mathematically is very important to me.	1	value	5
21. I will not be able to do word problems for homework unless the problems are easy.	1	ESU	5

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

HOMEWORK:

22. I have a lot of confidence that I can do homework word problems.	1	confidence	5
23. I like to do hard homework word problems because I learn more math by working them.	1	ILG	5
24. If I get homework word problems right, I usually do not know why.	1	unkn control	5
25. If I can do the word problems I get for homework, it is because I spend enough time on them.	1	ISC	5
26. I feel relaxed when I am doing math word problems at home.	1	anxiety	5
27. If I am unable to do homework word problems, it is because the math book is confusing.	1	ESU	5
28. The math word problems I get for homework are interesting to me.	1	interest	5
29. I would do challenging math word problems for homework if I could get a better grade.	1	EPG	5
30. I usually do not understand why I get word problems for homework wrong.	1	unkn control	5
31. I like to do challenging word problems for homework because solving them helps me learn math.	1	ILG	5
32. If I cannot do homework word problems, it is because the problems are confusing.	1	ESU	5
33. The only reason I do my math homework word problems is because my math teacher tells me I have to.	1	EPG	5
34. Working on word problems for homework is very boring.	1	interest	5

1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True

HOMEWORK:

35. I do not have any confidence when it comes to doing word problems for homework.	1	confidence	5
36. Doing word problems for homework does not make me nervous.	1	anxiety	5
37. I know I can do word problems for homework because I work hard on them.	1	ISC	5
38. If I cannot do math homework word problems, it is because I am not smart enough.	1	ISU	5
39. Being able to solve the word problems I get for homework is not important to me.	1	value	5

Appendix 4-2 - Hand Tally Form

Name of Student_____________________________ Date _____ Class ________

HAND TALLY FORM FOR MATHEMATICS ASSESSMENT QUESTIONNAIRE

Metacognitive Statements

Directions: Place a tally on the line next to the statement number each time a student responds NO, MAYBE or YES to a statement. The total number of students indicating each response should be recorded in the last three columns.

	Student Response				Class Totals		
Item	No	Maybe	Yes		No	Maybe	Yes
Before you began ...							
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
As you worked ...							
8				8			
9				9			
10				10			
11				11			
12				12			
13				13			
14				14			
15				15			
16				16			
After you finished ...							
17				17			
18				18			
19				19			
20				20			

DURING CLASSROOM INSTRUCTION

Self-regulatory statements

Directions: Place a tally on the line next to the statement number each time a student responds **VERY TRUE (VT)**, **TRUE (T)**, **SORT OF TRUE (S-T)**, **NOT VERY TRUE (NVT)**, and **NOT AT ALL TRUE (NT)**. The total number of students indicting each response should be recorded in the last five columns.

	Student Response						Class Totals				
	Very True	True	Sort of True	Not Very True	Not at all True		VT	T	S-T	NVT	NT
At the beginning of a math lesson											
1						1					
2						2					
3						3					
4						4					
5						5					
6						6					
During a math lesson...											
7						7					
8						8					
9						9					
10						10					
11						11					
12						12					
13						13					
14						14					
At the end of a math lesson ...											
15						15					
16						16					
17						17					
18						18					
19						19					

DURING CLASSROOM INSTRUCTION

Other Thoughts and Feelings

Directions for an individual student: Place a check on the line next to the statement if the response is one of the two indicated. For example, if a student responds 4 or 5 to item 28, put a check on the line after 28. If the student responds 1, 2 or 3 - leave the line blank.

Value
Item response
26 (1 or 2) ________
28 (4 or 5) ________
34 (4 or 5) ________
# of checks ______

Internal Learning Goals
Item response
30 (4 or 5) ________
32 (4 or 5) ________
42 (4 or 5) ________
# of checks ______

External Stable Uncontrollable
Item response
23 (1 or 2) ________
29 (1 or 2) ________
46 (1 or 2) ________
# of checks ______

Interest
Item response
24 (4 or 5) ________
44 (1 or 2) ________
49 (4 or 5) ________
# of checks ______

External Performance Goals
Item response
25 (1 or 2) ________
36 (1 or 2) ________
40 (1 or 2) ________
# of checks ______

Unknown Control
Item response
21 (1 or 2) ________
33 (1 or 2) ________
38 (1 or 2) ________
# of checks ______

Confidence
Item response
20 (4 or 5) ________
31 (1 or 2) ________
48 (1 or 2) ________
# of checks ______

Internal Stable Uncontrollable
Item response
22 (1 or 2) ________
37 (1 or 2) ________
41 (1 or 2) ________
# of checks ______

Anxiety
Item response
27 (1 or 2) ________
35 (4 or 5) ________
39 (1 or 2) ________
# of checks ______

Internal Stable Controllable
Item response
43 (4 or 5) ________
45 (4 or 5) ________
47 (4 or 5) ________
# of checks ______

Areas of Need

Value ______
Interest ______
Confidence ______
Anxiety ______
Int. Learn. Goal ______
Ext. Perf. Goal ______
Int. Stab. Uncon. ______
Int. Stab. Cont. ______
Ext. Stab. Uncon. ______
Unknown Control ______

WORKING WITH OTHER STUDENTS

Self-regulatory statements

Directions: Place a tally on the line next to the statement number each time a student responds **VERY TRUE** (VT), **TRUE** (T), **SORT OF TRUE** (S-T), **NOT VERY TRUE** (NVT), and **NOT AT ALL TRUE** (NT). The total number of students indicting each response should be recorded in the last five columns.

	Student Response						Class Totals				
	Very True	True	Sort of True	Not Very True	Not at all True		VT	T	S-T	NVT	NT
Before beginning to solve ...											
1						1					
2						2					
3						3					
4						4					
5						5					
6						6					
7						7					
While working a word problem ...											
8						8					
9						9					
10						10					
11						11					
12						12					
13						13					
14						14					
15						15					
After doing a word problem ...											
16						16					
17						17					
18						18					
19						19					
20						20					
21						21					
22						22					
23						23					

WORKING WITH OTHER STUDENTS

Other Thoughts and Feelings

Directions for an individual student: Place a check on the line next to the statement if the response is one of the two indicated. For example, if a student responds 4 or 5 to item 32, put a check on the line after 32. If the student responds 1, 2 or 3 - leave the line blank.

Value
Item response

32 (4 or 5) ________
44 (4 or 5) ________
46 (1 or 2) ________
# of checks ______

Internal Learning Goals
Item response

29 (4 or 5) ________
33 (4 or 5) ________
39 (4 or 5) ________
# of checks ______

External Stable Uncontrollable
Item response

35 (1 or 2) ________
45 (1 or 2) ________
50 (1 or 2) ________
# of checks ______

Interest
Item response

30 (4 or 5) ________
31 (4 or 5) ________
51 (1 or 2) ________
# of checks ______

External Performance Goals
Item response

37 (1 or 2) ________
43 (1 or 2) ________
53 (1 or 2) ________
# of checks ______

Unknown Control
Item response

28 (1 or 2) ________
42 (1 or 2) ________
47 (1 or 2) ________
# of checks ______

Confidence
Item response

24 (4 or 5) ________
27 (1 or 2) ________
48 (4 or 5) ________
# of checks ______

Internal Stable Uncontrollable
Item response

26 (1 or 2) ________
38 (1 or 2) ________
52 (1 or 2) ________
# of checks ______

Anxiety
Item response

25 (4 or 5) ________
31 (4 or 5) ________
40 (1 or 2) ________
# of checks ______

Internal Stable Controllable
Item response

34 (4 or 5) ________
41 (4 or 5) ________
49 (4 or 5) ________
# of checks ______

Areas of Need

Value ______
Interest ______
Confidence ______
Anxiety ______
Int. Learn. Goal ______
Ext. Perf. Goal ______
Int. Stab. Uncon. ______
Int. Stab. Cont. ______
Ext. Stab. Uncon. ______
Unknown Control ______

HOMEWORK

Self-regulatory statements

Directions: Place a tally on the line next to the statement number each time a student responds **VERY TRUE** (VT), **TRUE** (T), **SORT OF TRUE** (S-T), **NOT VERY TRUE** (NVT), and **NOT AT ALL TRUE** (NT). The total number of students indicting each response should be recorded in the last five columns.

	Student Response					Class Totals				
	Very True	True	Sort of True	Not Very True	Not at all True	VT	T	S-T	NVT	NT
Before you begin ...										
1										
2										
3										
While working ...										
4										
5										
6										
After working ...										
7										
8										
9										

HOMEWORK

Other Thoughts and Feelings

Directions for an individual student: Place a check on the line next to the statement if the response is one of the two indicated. For example, if a student responds 4 or 5 to item 20, put a check on the line after 20. If the student responds 1, 2 or 3 - leave the line blank.

Value
Item response

12 (1 or 2) ________

20 (4 or 5) ________

39 (1 or 2) ________

# of checks ________

Internal Learning Goals
Item response

15 (4 or 5) ________

23 (4 or 5) ________

31 (4 or 5) ________

# of checks ________

External Stable Uncontrollable
Item response

21 (1 or 2) ________

27 (1 or 2) ________

33 (1 or 2) ________

# of checks ________

Interest
Item response

18 (4 or 5) ________

28 (4 or 5) ________

34 (1 or 2) ________

# of checks ________

External Performance Goals
Item response

14 (1 or 2) ________

29 (1 or 2) ________

33 (1 or 2) ________

# of checks ________

Unknown Control
Item response

11 (1 or 2) ________

24 (1 or 2) ________

30 (1 or 2) ________

# of checks ________

Confidence
Item response

13 (1 or 2) ________

22 (4 or 5) ________

35 (1 or 2) ________

# of checks ________

Internal Stable Uncontrollable
Item response

10 (1 or 2) ________

16 (1 or 2) ________

38 (1 or 2) ________

# of checks ________

Anxiety
Item response

19 (1 or 2) ________

26 (4 or 5) ________

36 (4 or 5) ________

# of checks ________

Internal Stable Controllable
Item response

17 (4 or 5) ________

25 (4 or 5) ________

37 (4 or 5) ________

# of checks ________

Areas of Need

Value ______

Interest ______

Confidence ______

Anxiety ______

Int. Learn. Goal ______

Ext. Perf. Goal ______

Int. Stab. Uncon. ______

Int. Stab. Cont. ______

Ext. Stab. Uncon. ______

Unknown Control ______

Appendix 16

END

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Improvement (OERI)

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Date Filmed

March 21,1991